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Senator 28th District

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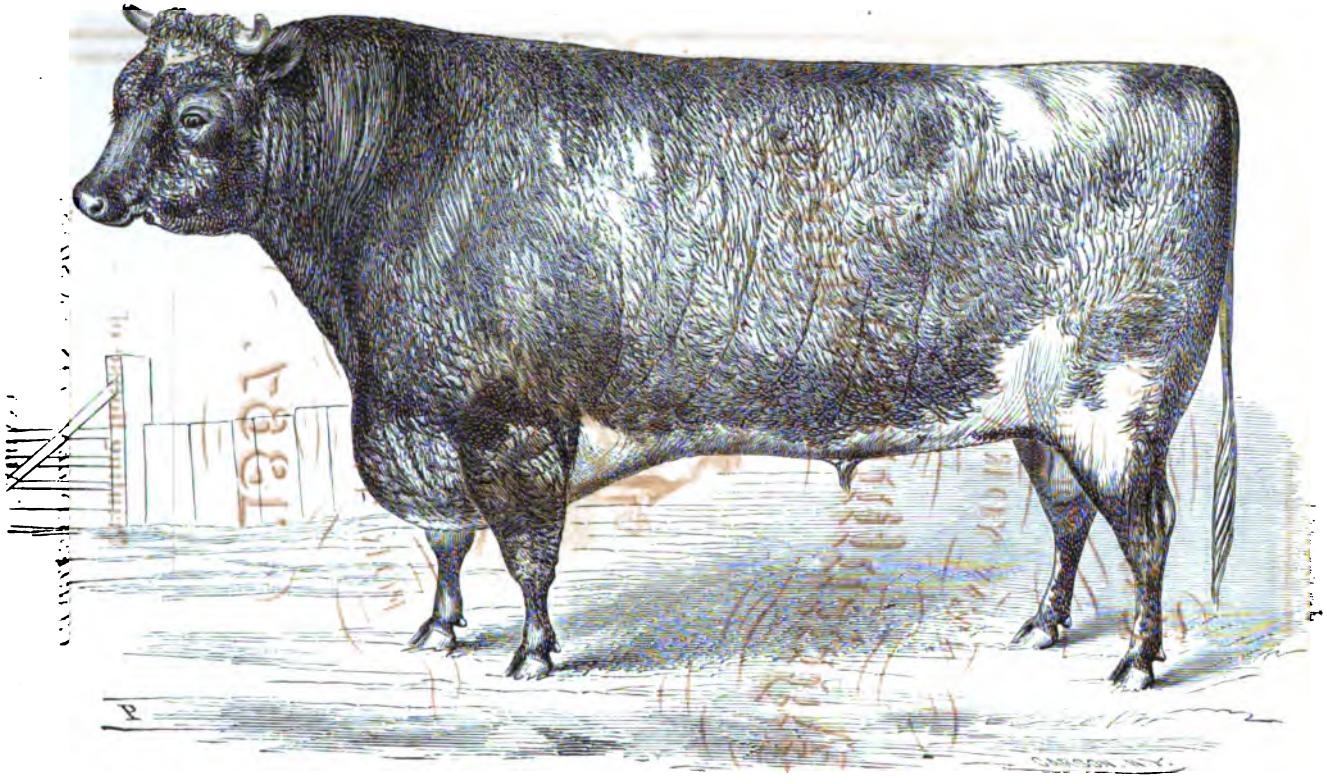

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Transactions

OF THE

NEW YORK STATE Agricultural Society.

FOR THE YEAR

1867.

Printing House of

CHARLES VAN BENTHUYSEN & SONS,

ALBANY.

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TRANSACTIONS

OF THE

New York State Agricultural Society,

WITH AN

ABSTRACT OF THE PROCEEDINGS

OF THE

COUNTY AGRICULTURAL SOCIETIES

PART I.

VOLUME XXVII—1867.

ALBANY:
VAN BENTHUYSEN & SONS' STEAM PRINTING HOUSE.
1868.

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1869. April 24
Gift of
Hon. E. H. Morgan
of Albany.

2 vol.

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CONSTITUTION

OF THE

NEW YORK STATE AGRICULTURAL SOCIETY.

The style of this Society shall be "The New York State Agricultural Society," Its object shall be to improve the condition of Agriculture, Horticulture and the Household Arts.

SEC. 1. The Society shall consist of such citizens of the State as shall signify in writing, their wish to become members, and shall pay on subscribing not less than one dollar, and annually thereafter one dollar, and also of Honorary and Corresponding members.

The Presidents of County Agricultural Societies, or a delegate from each, shall, ex-officio be members of this Society.

The payment of ten dollars or more, shall constitute a member for life, and shall exempt the donor from annual contributions.

SEC. 2. The officers of the Society shall consist of a President, eight Vice-Presidents, one to be located in each Judicial district, a Recording Secretary, a Corresponding Secretary, a Treasurer, an Executive Committee, to consist of the officers above named and eight additional members; and five of the ex-Presidents shall be ex-officio members of the Executive Committee, and these five shall consist of the five ex-Presidents whose term of office has last expired, of whom three shall constitute a quorum; and that the ex-Presidents of the Society, not members of the Executive Committee, shall constitute a Board of Councillors, to whom may be referred, for consultation and advice, all questions that may from time to time arise, and in the decision of which the Society may in any manner be interested; and a General Committee, the members of which shall be located in the several counties, and be equal to the representatives in the House of Assembly.

SEC. 3. The Recording Secretary shall keep the minutes of the Society. The Corresponding Secretary shall carry on the corres-

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pondence with other Societies, with individuals and with the General Committee, in the furtherance of the objects of the Society.

The Treasurer shall keep the funds of the Society, and disburse them on the order of the President or a Vice-President, countersigned by the Recording Secretary, and shall make a report of the receipts and expenditures at the annual meeting in February.

The Executive Committee shall take charge of and distribute or preserve all seeds, plants, books, models, &c., which may be transmitted to the Society; and shall have also the charge of all communications designed or calculated for publication, and so far as they may deem expedient, shall collect, arrange and publish the same in such manner and form as they shall deem best calculated to promote the objects of the Society.

The General Committee are charged with the interests of the Society in the counties in which they shall respectively reside, and will constitute a medium of communication between the Executive Committee and the remote members of the Society.

SEC. 4. There shall be an annual meeting of the Society on the second Wednesday of February, in the city of Albany, at which time all the officers shall be elected by a plurality of votes, and by ballot, with the exception of the General Committee for the counties, which may be appointed by the Executive Committee, who shall have power to fill any vacancies which may occur in the office of the Society during the year. Extra meetings may be convoked by the Executive Committee. Fifteen members shall be a quorum for the transaction of business.

No person shall be qualified to vote at any election for officers of the Society, unless he shall have been a member of the Society for at least thirty days prior to such election.

SEC. 5. The Society shall hold an annual cattle show and fair at such time and place as shall be designated by the Executive Committee.

SEC. 6. The Constitution may be amended by a vote of two-thirds of the members attending any annual meeting upon one year's previous notice in writing.

STATE AGRICULTURAL ROOMS,
February, 1867.

I certify the above to be a true copy of the Constitution of the New York State Agricultural Society.

B. P. JOHNSON, *Cor. Secretary.*

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OFFICERS FOR 1868.

PRESIDENT

THOMAS H. FAILE, New York.

VICE-PRESIDENTS,

1st district, JOHN HAVEN, New York.
2d district, SAMUEL THORNE, Dutchess.
3d district, ADIN THAYER, Jr., Rensselaer.
4th district, MILO INGALSBE, Washington.
5th district, HARRIS LEWIS, Herkimer.
6th district, WILLIAM M. ELY, Broome.
7th district, H. T. E. FOSTER, Seneca.
8th district, GEORGE A. MOORE, Erie.

CORRESPONDING SECRETARY,

B. P. JOHNSON, Albany.

RECORDING SECRETARY,

THOMAS L. HARISON, St. Lawrence

TREASURER,

LUTHER H. TUCKER, Albany.

EXECUTIVE COMMITTTEE.

RICHARD CHURCH, Allegany,
JAMES GEDDES, Onondaga,
S. T. TABER, Queens.
L. D. MITCHELL, Monroe,
WM. M. BURR. Jr., Madison,
A. B. CORNELL, Tompkins,
B. F. ANGEL, Livingston,
J. D. WING, New York.

MECHANICAL AND CONSULTING ENGINEER,

HENRY WATERMAN, Hudson.

CHEMIST TO THE SOCIETY,

Prof. CHARLES H. PORTER.

ENTOMOLOGIST,

ASA FITCH, M. D.

EX-PRESIDENTS,

Year.	Name.	Location fair.	Year.	Name.	Location fair.
1841..	Joel B. Nott.....	Syracuse.	1855..	Samuel Cheever.....	Elmira.
1842..	*James S. Wadsworth	Albany.	1856..	T. S. Faxton.....	Watertown.
1843..	Same.....	Rochester.	1857..	A. S. Upham	Buffalo.
1844..	*J. P. Beekman.....	Po'keepsie.	1858..	W. T. McCown.....	Syracuse.
1845..	B. P. Johnson	Utica.	1859..	A. B. Conger	Albany.
1846..	J. M. Sherwood.	Auburn.	1860..	B. N. Huntington....	Elmira.
1847..	George Vail	Saratoga.	1861..	George Geddes, ...	Watertown.
1848..	Lewis F. Allen.....	Buffalo.	1862..	Ezra Cornell.....	Rochester.
1849..	*John A. King.....	Syracuse.	1863..	*Edward G. Faile	Utica.
1850..	E. P. Prentice	Albany.	1864..	James O. Sheldon ...	Rochester.
1851..	*John Delafield	Rochester.	1865..	T. C. Peters	Utica.
1852..	*Henry Wager	Utica.	1866..	J. Stanton Gould....	Saratoga.
1853..	Lewis G. Morris.....	Saratoga.	1867..	Marsena R. Patrick..	Buffalo.
1854..	William Kelly.....	New York.			

Monthly meeting of the Executive Committee, first Thursday in each month.

Annual meeting of the New York State Agricultural Society, second Wednesday in February.

STATE AGRICULTURAL ROOMS.—The Secretary's office is in the new Agricultural Hall, corner of State and Lodge streets.

* Deceased.

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LIFE MEMBERS.

[Deceased members are marked with an asterisk.]

A.

Allen, William M., Harlem.
Allen, Lewis F., Black Rock.
Aspinwall, J. L., Barrytown.
Agnew, Alexander, New York.
Allen, John, New York.*
Aycrigg. T. G., New Jersey.
Andrews, B. H., Waterbury, Conn.
Aspinwall, William H., New York.
Abernethy, Charles, New York.
Ames, D. T., Syracuse.
Arnold, William E., Otego.
Austin, J. Jr., Albany.
Adriance, J. P., Poughkeepsie.
Arnold, B. G., New York.
Agnew, Cornelius R., New York.
Angel, B. F., Geneseo.

B.

Beekman, John P., Kinderhook.*
Bell, Thomas, Eatontown, N. J.
Buell, William. Rochester.*
Brown, Lewis B., Westchester.
Boughton, Chauncey, Waterford.
Bowen, Henry C., Brooklyn.
Burkhalter, Charles, New York.*
Balcom, Uri, Oconto, Wisconsin.
Brown. William Smith, New York.
Boorman, James, Hyde Park.*
Brown, Lewis M., New York.
Bradley, George C., Watertown.
Boyce, William, New York.
Brown, William J., Fairhaven.
Byram, A. G., New York.
Baldwin, Harvey, Syracuse.*
Buck, A. H., Lowville.
Burr, William M. Jr., Cazenovia.
Bulkely, D. A., Williamstown, Mass.
Bailey, Isaac H., New York.
Becar, Noel J., New York.*
Babcock, Samuel D., New York.
Butler, B. C., Luzerne.
Babcock, F. M., New York.
Bowne, S. R., Flushing.
Bruen, Alexander M., Scarsdale.
Brooks, Daniel E., New York.
Butler, Charles, New York.
Bogart, M. D., Rockland Lake.
Barry, P., Rochester.
Bard, John, Barrytown.*
Bradley, S. W., Olean.
Boardman, Truman, Trumansburgh.
Benham, A. B., Dryden.
Bailey, N. P., Fordham.
Bonesteel, Peter S., Victor.
Brown, George D., Lowville.
Brown, George H., Millbrook.
Baker, B. M., Rochester.
Beebe, William, New York.
Butterfield, J., Utica.
Bliss, Jonathan.
Brown, John Crosby, New York.
Brown, James, New York.
Barber, A. D., New York.
Baldwin, A., Yonkers.
Brizee, Teunis, Pittsford.
Baker, A. Y., Hammondsport.
Birdsall, Benjamin. Mendon Center.
Barto, H. D., Trumansburgh.
Bowne, Robert, New York.
Beadle, E. L., M. D., Poughkeepsie.
Boyce, Ker, Flushing.
Brown, Alexander, North Bridgewater.
Bryden, Robert E., New Hartford.
Barnard, Charles, Utica.
Brown, J. P., Utica.
Bowen, H., Medina.
Butterfield, Charles E., Utica.
Blanchard, J. H., Utica.
Burch, H. M., ——.
Baker, B. F., Ballston.
Brown D. D. S., Rochester.
Blake, W. C., Northfield, Vt.
Beckwith, B. M., Plattsburgh.
Bennett, Wm. H., Saratoga Springs.
Bostock, E., Albany.
Banks, John, Bainbridge.
Bartlett, H. B, Paris.
Baker, J. V., Comstock's Landing.
Butterfield, Daniel, New York.
Boswell, John, Chili.
Bell, John H., West Brighton.
Babbitt, B. T., New York.
Bicknell, J. Y., Westmoreland.
Brown, J. Emery, Churchville.

C.

Campbell, William Bayard, New York.
Corning, Erastus, Albany.
Corning, Erastus Jr., Albany.
Clark, George, Springfield.
Coleman, Robert B., New York.*
Crocker, David Jr., New York.*
Clafflin, Horace B., Brooklyn.
Case, Thomas R., Simsbury, Ct.
Corey, John A., Saratoga Springs.

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Curtis, E. L. B., Danby.
Cromwell, William, New York.
Cook, E. G., Belleville.
Campbell, John, New York.
Conger, A. B., Waldberg.
Clarke, Alfred, Springfield.
Crane, John J., Morrisania.
Clarkson, Augustus, Potsdam.*
Chesebro, E., Guilderland.*
Catlin, D. W., New York.*
Chambers, James, Scarsdale.
Clement, Isaac, Mechanicsville.
Cocks, Isaac H., North Hempstead.
Cornell, Ezra. Ithaca.
Crittenden, Norman, Ithaca.
Cornell, Alonzo B., Ithaca.
Cornell, Franklin C., Ithaca.
Cornell, O. H. Perry, Ithaca.
Chrystie, Albert N., Havre, France.
Chauncey, Henry Jr., New York.
Chatfield, T. I., Owego.
Campbell, Samuel, New York Mills.
Carroll, Charles H., Geneseo.*
Cornell, Charles Ezra, Ithaca.
Cobb. Emory, Chicago.
Camp, Hugh N., New York.
Chipman, H. W. White Plains.
Childs, S. D., Utica.*
Churchill, A., Utica.*
Cogswell, W. L., New York.*
Champlin, C. D., Hammondsport.
Crossman, C. F., Rochester.*
Chatfield, A. F., Albany.
Copeman, A. S., Utica.
Cooke, Rolland C., Whitehall.
Collender, Hugh W., New York.
Coffin, Edmund, New York.
Cole, Walter, Batavia.
Coan, Luke, Westmoreland.
Clark, Leander, Newburgh.
Crofoot, James R., Constableville.
Clarke, Almonde, Whitestown.
Cary, H. N., Whitesboro.
Coulter, J. E., New York.
Cowdin, Elliott C., New York.
Carpenter, Franklin, South Corinth.
Chamberlain, D. D., New York.
Church, Richard, Belvidere.
Cady, Charles, Dryden.
Crego, Russell, Albany.
Church, Elihu, Riga.
Cooper, Joseph M., New York.
Crossman, C. W., Rochester.

D.

Delavan, H. W., Ballston.*
Delafield, John, Oakland.*
Dickey, George, New York.*
Dinsmore, William B., Staatsburgh.
Demarest, Abram A., New York.
Defreest, John K., Defreestville.
Draper, Simeon, New York.*
De Witt, Edward, New York.
Dater, Philip, New York.*
Dillon, Robert B., New York.
De Forest, D. W. C., Defriestville.
Dill, John B., Auburn.
Dows, David, New York.
Devereux, John C., Ellicottville.
Dollner, Harold, New York
Doolittle, Charles H., Utica.
Dagwell, John, Utica.
Dorland, William L., Dean's Corners.
Dickey, Charles D., New York.
De Angelis, W. W., Holland Patent.
Dodge, Henry, Washington Mills.
Downer, Charles, Utica.
Dewey, C. D., Port Leyden.
Dodge, W. E., New York.
Dater, James, New York.
Doelker, George, Albany.
Dike, Henry A., New York.
Dwight, J. W., Dryden.
Davenport, Charles L., Syracuse.

E.

Edmonds, F. W., Bronxville.*
Emmett, Thomas Addis, Astoria.*
Earle, Morris, New York.*
Ellwanger, George, Rochester.
Edwards, Edward, South Corinth.
Erwin, Charles H., Painted Post.
Eddy, John W., ——.
Erwin, E. H., Painted Post.

F.

Fairbanks, T., St. Johnsbury, Vt.*
Fairbanks, E., St. Johnsbury, Vt.
Fairbanks. H., St. Johnsbury, Vt.
Fellows, Joseph, Bath.
Foster, H. Ten Eyck, Lakeland.
Finlay. J. Beekman, Saratoga Springs.
Faile, Edward G., New York.*
Faile, Thomas H. New York.
Faile, Edward, West Farms.
Faile, Charles V., New York.
Faile, Samuel, White Plains.
Fox, William W., New York.*
Furman, John M., New York.
Faxton, T. S., Utica.
Fox, George S., West Farms.*
Forbes, Paul S., Beaverwyck.
Frost, J. T., Clinton Point.
Ferris, Wm. L., Westchester.*
Faile, Henry, New York.
Frame, William, Flushing.*
Faile, Thomas H. Jr., New York.
Fields, P. H., Geneva.
Fitch. Asa, East Greenwich.
Fuller, Dudley B., New York.*
Furgeson, Amos, Utica.
Farwell, Samuel, Utica.
Foster, James S., New Hartford.
French, L. L., Page's Corners.
Freer, S. D., Cortlandville.
Freeman, Isaac, Bemis Heights
Filley, Samuel R., Woodstock.
Ford, Henry A., Westerlo.
Foster, Frederick G., New York.
Foster, Edmund B., West Stockbridge.

G.

Geddes, George, Fairmount.
Gauly, William M., New York.*

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Goldsmith, R. F., West Southold, L. I.
Glenn, W. W., Baltimore, Md.*
Granger, Oscar, Saratoga Springs.
Gallup, S. M., New York.
Greig, John, Canandaigua.*
Griffen, Elihu, Clinton Corners.
Green, John C., New York.
Granger, Gideon, Canandaigua.
Gilman, Arthur, Lee, Mass.
Geddes, James, Fairmount.
Green, A. H., New York.
Gunn, S. W., Kirkland.
Gilbert, E. M., Utica.
George, Thomas, Newburgh.
Gandy, Shephard, New York.
Galbraith, Thomas, Washington Hollow.
Gibbs, I. E., Watertown.
Greenman, Silas C., Utica.
Gregory, H. C., Unadilla.
Gibbs, R. B., Harpersfield.
Granger, Foster O., Saratoga Springs.
Grumman, Wm., Newark, N. J.
Gordon, Robert, New York.
Griswold, John A., Troy.
Gould, Thomas, Aurora.

H.

Huntington, Benjamin N., Rome.
Hartshorne, George, Rahway, N. J.
Haviland, I. E., Hempstead Branch.
Haight, Edward, Westchester.
Hunt, Wilson G., New York.
Hopkins, Lucius, New York.
Herrick, John H., New York.
Harold, John, Hempstead.
Holmes, A. B., New York.
Hastings, George F., Shusan.
Hoadley, Luther, Harwinton, Conn.
Hayward, E. S., Rochester.
Hurst, William, Albany.
Hall, Peleg, New York.
Hoe, Richard M., New York.
Hurlbut, H. A., New York.
Hamilton, D., Watervliet.*
Herrick, E. H., New York.*
Haven, John, New York.
Herrick, Jacob B., New York.*
Howell, Benjamin H., New York.
Hoe, Peter S., New York.
Hilton, Joseph, New Scotland.
Hopkins, Henry, New York.
Houpt, Henry H., Dryden.
Hungerford, Solon D., Adams.
Huestis, Hugh, Adams.
Hovey, C. M., Boston.
Hayes, Clark I., Unadilla.
Harison, Thomas L., Morley.
Harison, Richard M., New York.
Harison, George D. L., New York.
Harison, Francis, New York.
Howland, Obadiah, Auburn.
Harberger, J. S., New York.
Hopkins, O., New York.
Heyne, Carl, Red Hook.
Huntington, E., Rome.
Hart, H. R., Utica.
Hawley, J. S., Binghamton.
Hallett, J. S., New York.
Hager, John G., Rhinebeck.
Houghton, W. J., ——.
Harder, M., Cobleskill.
Hoyt, D. C., ——.
Hendrick, James, Albany.
Harris, Joseph, Rochester.
Herring, Silas C., New York.
Hoyt, Alfred M., New York.
Hicks, B. D., North Hempstead.
Hatch, Lewis M., Ashville, N. C.
Hoge, William, Tarrytown.
Holmes, Wm. M., Greenwich.
Hess, Newton, West Somerset.
Hubbell, Alrick, Utica.
Hunt, Ward, Utica.
Hopkins, W. R., Utica.
Howland Joseph, Mattewan.
Heffron, D. S., Utica.
Holden, E. C., McGrawville.
Hodge, John, Lockport.

I.

Isham, W. B., New York.*
Irvin, Richard, New York.
Ives, Julius Jr., New York.
Ives, Julius, New York.
Ingalsbe, H. H., South Hartford.
Ingalsbe, Milo, South Hartford.
Ingalsbe, James L., South Hartford.

J.

Johnson, B. P., Albany.
Jones, Edward, Rhinebeck.
Jackson, John C., New York.
Johnson, Samuel Wm., Ellicottville.
Johnston, James Boorman, New York
Johnston, William S., Poughkeepsie.
Jay, John, Katonah.
Jones, O. W., New York.
Johnson, William, Geneva.*
Johnson, Bradish, New York.
Johnson, R. L., Albany.
Jervis, John B., Rome.
Jones, David R. Floyd, S. Oyster Bay
Johnston, John T., New York.
Jones, Morris R , Rome.
Juliand, J. Jr., Bainbridge.
Judd, Orange, New York.
Jewell, A. L., Waltham, Mass.

K.

Kelly, William, Rhinebeck.
King, John A., Jamaica.*
Keene, Stephen S., M. D., New York.*
Kirtland, B. B., Greenbush.*
Kennedy, Robert L., New York.
Ketchum, Morris, New York.
Keese, Samuel T., New York.
Kidder, K. P., Burlington, Vt.
Kelly, Henry, New York.*
King, John A. Jr., Long Island.
Kelly, William Jr., New York.
Kellogg, P. V., Utica.
King, P. V., New York.
Kirk, George Wistar, New York.

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L.

Leray, De Chaumont, Leraysville.*
Lenox, James, New York.
Livermore, Charles F., New York.
Lee, John R., Buffalo.
Ludlow, William H., Sayville.
Lincklaen, Ledyard, Cazenovia.*
Lawrence, Edward A., Flushing.
Leggett, Edward W., Harlem.*
Lockwood, E., New York.*
Landon, William, Albany.*
Lee, William H., New York.
Leavitt, Henry S., New York.
Lockwood, George, New York.
Leland, Simeon, New York.
Lawrence, F. N., Flushing.
Leonard, Moses G., Rockland Lake.
Lexow, Rudolph, Nanuet.
Livingston, E. P., Clermont.*
Lawrence, L. H., Utica.
Lawyer, Luther, Perth River.
Lowber, R. W., New York.
Lay, F. W., Greece.
Leverich, C. P., New York.
Lambert, W. G. Jr., Chappaqua.
Lord, J. Cowper, New York.
Lee, David B., New York.
Lorrillard, L. L., West Farms.
Look, S. J., Clayville.
Lyman, David, Middlefield, Conn.
Lord, H. G., ——.
Leland, W. W., Saratoga Springs.
Leland, C. E., Saratoga Springs.
Loomis, H. B., New York.
Lawrence, De Witt C., New York.
Lewis, Harris, Frankfort.
Leverich, Charles D., Newtown.

M.

McIntyre, J. McDonald, Albany.
Marvin, James M., Saratoga Springs.
Morris, Lewis G., Mt. Fordham.
McIntyre, Archibald, Albany.*
Maitland, William C., Fordham.
McGraw, Joseph Jr., Dryden.
Murray, George, New York.
Morris, Fordham, Mt. Fordham.
Morris, Francis, Mt. Fordham.
Munn, Samuel, Mott Haven.
Miller, James M., New York.
Miller, Daniel S., New York.
McGraw, John, West Farms.
Mortimer, John H., New York.
Marks, Enoch, Camillus.
Mather, F. E., New York.
Mordoff, M. C., Rochester.
Messenger, Thomas, Great Neck, L. I.
Masterton, Robert M., New York.
Maxwell, Hugh, New York.
McCredy, Dennis A., New York.
Moore, D. D. T., Rochester.
Maurau, S. E., White Lake
Mitchell, O. M., Saratoga Springs.*
Masterton, Alexander, Bronxville.
Munroe, Allen, Syracuse.
Maxon, Thomas V., Adams.
McCall, James S., Geneva.
Morss, B. G., Red Falls.
Morrison, James M., New York.
Matteson, James M., Jacksonville.
Morgan, J. E., Deerfield.
Middleton, R., Utica.
Mason, D. C., N. Hartford.
Mecke, J. A., New York.
Maitland, R. L., New York.
Mason, J. W., Brooklyn.
Moller, W. T., Irvington.
Mesick, P., Albany.
Mathewson, Park, New York.
Messenger, W. S., Great Neck, L. I
Minturn, Robert B., New York.
Matteson, O. B., Utica.
Millard, S. A., Clayville.
Mason, S. M., New Hartford.
Mann, J. F., Utica.
Melick, William B., Albany.
Matthewson, J. E., New Berlin Centre
Munson, E., Tyre.
Merriam, Charles M., Leyden.
Mowry, J. F., Deansville.
Moffat, John N., New York.
Miller, Seth, Constableville.
Merriam, C. L., Leyden.
Morrell, Robert, Manhassett.
Mitchell, Samuel L., New York.
Moon, C. B., Saratoga Springs.
Myers, John K., Yonkers.
Martin Z. Brovoshi, Morrisania.
Myers, Marvin S., Charlton.
Musselman, Chauncey, Phelps.

N.

Norton, Robert, New York.
Nourse, J., Boston.
Nellis, A. J., Bath.

O

Odell, William T., Ballston Spa.
Otis, H. G., Geneva.
Osgood, Jason C., Troy.
Olmstead, H. M., Morristown.
Osborn, Amos O., Waterville.
Ostrander, W. P., Schuylerville.

P.

Patrick, M. R., Manlius.
Prentice, Ezra P., Albany.
Plumb, Josiah B., Albany.
Phelps, Thomas W., New York.
Peet, Harvey P., New York.*
Pease, R. H., Albany.
Post, William, New York.*
Paton, Thomas, New York.
Phelps, Peter, Derby, Ct.
Phelps, Royal, New York.
Popham, William H., Scarsdale.
Pinkney, Thomas, Bronxville.
Pell, Robert L., Pelham Farm.
Punnett, James, New York.
Pye, Edward, Haverstraw.*
Pumpely, Harman, Albany.
Peck, Edgar F., Brooklyn.
Peters, T. C., Darien.
Pierson, Henry L., New York

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Pyle, James, New York.
Pratt, Zadock, Prattsville.
Park, Joseph, New York.
Palmer, Allen B., Geneva.
Penfold, E., New York.
Park, H. S., New York.
Pine, G. W., Herkimer.
Priest, Z. C., Utica.
Priest, D. E., Utica.
Palmer, J. L., Adams Centre.
Pine, Al, Pittstown.
Pomroy, William H., New York.
Peugnet, Charles, Cape Vincent.
Palmer, N., Hudson.
Palmer, T. G., Hudson.
Page, J. R., Sennett.
Penfold, E. Jr., New York.
Prentiss, J. H., Utica.
Palmer, A. W., Amenia.
Potter, Howard, New York.
Pearsall, N. B., Morris.
Purdy, Samuel M., West Farms.

R.

Rust, Philo N., Syracuse.*
Rotch, Francis, Morris.
Robinson, Henry, Newburgh.
Richardson, Thomas, Westchester
Reed, Almet, New York.
Rogers, Henry W., Buffalo.
Rathbun, L. W., Springfield.
Rotch, Francis M., Morris.*
Randall, Nathan, Syracuse.
Robbins, George A., New York.
Rutherford, Thomas H., East Chester.
Read, J. Meredith, Albany.
Randall, Benjamin, Adams.
Read, William G., New York.
Robinson, Charles, Fishkill Plains.
Reynolds, M. F., Rochester.
Rockwell, S. D., New York.
Read, J. H., Utica.
Randall, H. S., LL. D., Cortland.
Rankin, W., Charlotte.
Richards, D. C., Fort Washington
Rogers, D. E., Wheatland.
Rowe, J., Poughkeepsie.
Riggs, C. G., Turin.
Ramsdell, L., Greeneville.
Randall, N. W., Bristol Centre.
Reeve, J. H., Wells Corners.

S.

Saxton, C. M., St. Louis.
Seward, William H., Auburn.
Seymour, Horatio, Utica.
Sherwood, John M., Auburn.
Stetson, Charles A., New York.
Spencer, Lorillard, Throg's Neck.
Spinner, John D., Herkimer.
Stevens, E. R., Saratoga Springs.
Sheafe, J. F., Dutchess.
Smith, N. Everett, New York.
Smith, D. D., New York.
Smith, M. M., Rochester.
Sherman, C. A., New York.
Sherman, B. L., New York.
Spaulding, Henry F., New York.
Swan, Robert J., Rose Hill.
Stuart, Robert L., New York.
Stuart, Alexander, New York.
Sloane, Samuel, New York.
Sheldon, James O., Geneva.
Suydam, Henry Jr., New York.*
Sands, A. B., New York.*
Smith, Silas G., Mechanicsville.
Swan, Benjamin S. Jr., New York.
Slingerland, William H., Norman's Kill.
Schenck, William J., New York.
Southworth, John. Dryden.
Seney, George J., New York.
Smith, Thomas, New York.
Spofford, Paul, New York.
Shark, Anthony, Defreestville.
Sheldon, Lucius M., Geneva.
Swain, James P., Bronxville.
Simpson, William, West Farms
Strong, Benjamin W., Newtown.
Simpson, John V., West Farms.
Sherill, Eliakim, Geneva.*
Standring, L. S., Deer River.
Saunders, Thomas P., Adams.
Simpson, William Jr., New Hudson.
Sherwood, Frederick, New York.
Smith, Albert, New Rochelle.
Sisson, G. M., Ledyard.
Sherrill, Lewis, Greenville.
Southworth, J. E., New York.*
Sheldon, H. K., New York.
Sampson, G. G., Brooklyn.
Sutherland, J. H., Pittsford.
Shonnard, E. F., Yonkers.
Sherman S., Lundy's Lane.
Simpson, ——, White Plains.
Seaman, P., White Plains.
Sherman, Ira E., Sidney Plains.
Swan, William H., New York.
Stephenson, G. S., New York.
Southworth, ——, Utica.*
Savage, Thomas, N. Hartford.
Spriggs, J. I., Utica.
Spencer, J. E., Utica.
Sweezy, George W., New York.
Schuyler, Peter C., New York.
Seeley, D. W., Albany.
Sheldon, James, Geneva.
Swain, Thomas M., Bronxville.
Stillman, Charles, Woodstock.
Sturges, Jonathan, New York.
Schoonmaker, Henry, Cedar Hill
Sherman, W. C. H., Newburgh.
Sharp, Jacob, Rome.
Safford, Halsey, East Otto.
Staley, Daniel G., Albany.
Sandford, Charles, New York
Schreiner, O. H., New York.
Scott, John H., New York.
Stockwell, S. S., New York.
Stevens S. W., Rochester.

T.

Thompson, Samuel L., Setauket.
Tucker, Luther, Albany.
Thorne, Jonathan, Thornedale.

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Thorne, Edwin, New York.
Thorne, Samuel, Thorndale.
Titus, James H., Malone.
Taber, Samuel T., Roslyn, L. I.
Thomas, Francis Jr., New York.
Thayer, Adin Jr., Hoosick Falls.
Thompson, James, Ballston Spa.
Tappan, John L., New York.
Toole, William S., New York.
Terry, Edmund, Utica.
Thorne, Stephen, Utica.*
Tripp, Lemon B., North Castle.
Thomas, Herman, Saratoga Springs.
Thomas, John, Frankfort.
Ten Broeck, W. S., Rhinebeck.
Tweed, Wm. W., New York.
Tucker, Luther H., Albany.
Toby, Silas W., Hudson.
Toby, Reuben, Pittsford.
Taylor, John W.
Townsend, John, Albany.*

U.

Upham, A. S., Le Roy.
Underhill, Daniel, Jericho.
Underhill, Richard T., M.D., Croton Point Vineyard.

V.

Vail, George, Troy.
Van Rensselaer, Gen. Stephen, Albany.*
Van Rensselaer, Stephen Jr., Albany.*
Van Rensselaer, William P., Albany.
Van Pelt, Henry, New York.*
Van Rensselaer, R. H., Morris.
Van Antwerp, John, West Farms.
Van Alstyne, P. Edward, Kinderhook.
Van Wie, Peter, Cedar Hill.
Van Horn, G. H. E., Fonda.

W.

Wadsworth, James, Geneseo.*
Wadsworth, James S., Geneseo.*
Wadsworth, William W., Geneseo.*
Wells, Edward, Johnstown.
White, Hollis, Niagara Falls.
Ward, John, New York.*
Wells, Henry, Aurora.
Watson, William, West Farms.
Wainwright, C. S., Rhinebeck.
Wolfe, John David, New York.
Wykoff, S. S., New York.
Whitlock, Benjamin M., West Farms.*
Willetts, Robert, Bayside, L. I.
Wetmore, Prosper M., New York.
Wilkin, J. W., Orange county.
Weed, William H., New York.
Wilson, Catlin, Eutaw, Alabama.
Weston, Frederick, Sandy Hill.
Wendell, Herman, M. D., Albany.
Weed, W. W., Buffalo.*
White, William M., Canaseraga.
Woodworth, Augustus P., New York.
Whitney, Orla H., Mexico.
Walbridge, D. T., Rochester.
White, Hugh, Waterford.
Willard, G. L., Cold Spring.
Wight, R. A., New York.
Williams, J. B., Ithaca.
White, Rufus P., Adams.
Wood, Amos F., Woodville.
Ward, F. B., Le Roy.
Wolfe, N. H., New York.
Warner, Horatio G., Rochester.
Wende, Herman, Alden.
Wende, B. A., Alden.
Wood, Orin S., Montreal.
Winne, Jurian, Bethlehem.
Williams, J. E., New York.
Wackerhagen, E., Albany.
Wetmore, Benjamin C., New York.
Wadsworth, Craig W., Geneseo.
Williams, S. L., Perrinton.
Whitney, George J., Rochester.
Wilcox, A. T., Fayetteville.
Wheeler, G H., Hammondsport.
Wilbur, R. P., Lowville.
Woodford, F. T., Utica.
Walrath, Solomon, Rensselaer Falls.
Willetts, Samuel, New York.
Walcott, W. D., New York Mills.
Wilson, Charles S., Utica.
Wood, E. D., Utica.
Wolcott, Dr. S. G., Utica.
Willard, X. A., Little Falls.
Watson, H. M., Albany.
Wier, Henry, Johnsonville.
Wing, John D., Dutchess.
Wade, Elias Jr., New York.
Watts, John, Ithaca.
Wood, W. Anson, Hoosick Falls.
Wells, Eugene, Rhinebeck.
Warner, Daniel D., Canaan.

Y.

Yelverton, Robert, New York.

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CONTENTS.

PAGE.

Report of the Executive Committee 1
Trial of plows, &c 1
Abortion 3
Rinderpest, commissioners 5
Death of ex-President, the Hon. John A. King 5
Resolutions thereon 6
Annual Meeting, 1868 10
Treasurer's report 10
Account for 1867 17
Election of officers 19
Premiums at winter meeting 21
Resolutions in relation to the late Rev. C. E. Goodrich 23
Orange Judd—offer of special premiums for wheat 25
Award of premiums at the Fair of 1867 26
Fair of 1867, report by X. A. Willard 77
Discussions at State Fair Evening Meetings:
Apple culture—N. T. Brooks 132
Cooking food for animals—E. W. Stewart 155
Address of President Patrick 182
Report of J. C. Dalton, M. D., commissioner of the abortion investigation ... 198
Eulogy on the late Hon. John A. King 235
Rinderpest, first report 253
second report 260
Report on Trial of Plows 384
Introductory 384
History of the plow 389
On the objects to be accomplished by plowing 512
On some of the practical questions in plows and plowing 526
On the line of draught in plows 544
On the mechanical conditions of the plow 562
Report of the judges 579
Supplementary trials 635
County Societies' Reports:
Albany 657
Allegany 659
Broome 660
Cayuga 660
Cattaraugus 661
Chautauqua 662
Chemung 663
Chenango 663

Digitized by Google

COUNTY SOCIETIES' REPORTS (Continued): PAGE.
Clinton 664
Columbia 665
Cortland 666
Delaware 666
Dutchess 667
Erie 669
Essex 670
Franklin 671
Fulton 673
Genesee 673
Greene 674
Herkimer 687
Jefferson 691
Lewis 691
Livingston 691
Monroe 693
Montgomery 694
Niagara 695
Ontario 696
Orange 696
Orleans 696
Oswego 697
Otsego 697
Putnam 698
Queens 699
Rensselaer 721
Rockland 721
St. Lawrence 722
Saratoga 725
Schoharje 732
Schuyler 733
Seneca 734
Steuben 735
Suffolk 756
Tioga 758
Tompkins 758
Ulster 759
Warren 767
Washington 767
Wayne 768
Westchester 770
Wyoming 772
Yates 773
REPORTS OF TOWN AND UNION SOCIETIES AND FARMERS' CLUBS:
American Institute 775
Allen Settlement Club 786
Otisco Farmers' Club 787
Barton Society 788
Brookfield Society 788

Digitized by Google

PAGE

REPORTS OF TOWN AND UNION SOCIETIES AND FARMERS' CLUBS (Continued):
Camden Society 790
Castle Creek Club 790
Cazenovia Association 790
Constantia Society 791
Delhi Society 791
East Maine Club 793
Ellisburgh, Adams and Henderson Society 794
Galen Society 795
Gouverneur Society 796
Hammond Society 797
Hess Road Club 798
Highland Society 800
Iroquois Society 801
Kirkland Society 803
Lenox Association 805
Little Falls Club 806
Manlius and Pompey 872
Moravia Society 872
Moriah Society 875
Skaneateles Club 875
Schenevus Valley Society 876
Susquehanna Valley Society 876
Thornhill Club 878
Trenton Society 879
Vernon Society 879
Vienna Society 879
Winfield Society 880
Ulysses, Covert and Hector Society 880
Washington County, First Assembly District, Society 881
Yorktown Society 882
American Dairying, by X. A. Willard 883
REPORT OF DR. A. FITCH, ENTOMOLOGIST 889
Buffalo tree-hopper 889
Yellow-lined and red-lined leaf-hoppers 893
Flowery primrose moth 900
Ohio currant saw-fly 908
Currant worm and saw-fly 909
Donations to the Library and Museum 933
Texas Cattle Disease 941
Preliminary pages:
Constitution iii
Officers for 1868, and ex-Presidents v
Life members vii

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State of New York.

No. 163.

IN ASSEMBLY,

April 6, 1868.

TRANSACTIONS OF THE NEW YORK STATE AGRICULTURAL SOCIETY.

AGRICULTURAL ROOMS,
ALBANY, *April* 6, 1868.

To the Hon. WILLIAM HITCHMAN,
Speaker of the Assembly of the State of New York:

SIR—I herewith transmit to the Legislature, the Twenty-seventh Annual Report of the New York State Agricultural Society, and the abstracts and documents accompanying the same.

Very respectfully,
Your obedient servant,
B. P. JOHNSON,
Corresponding Secretary.

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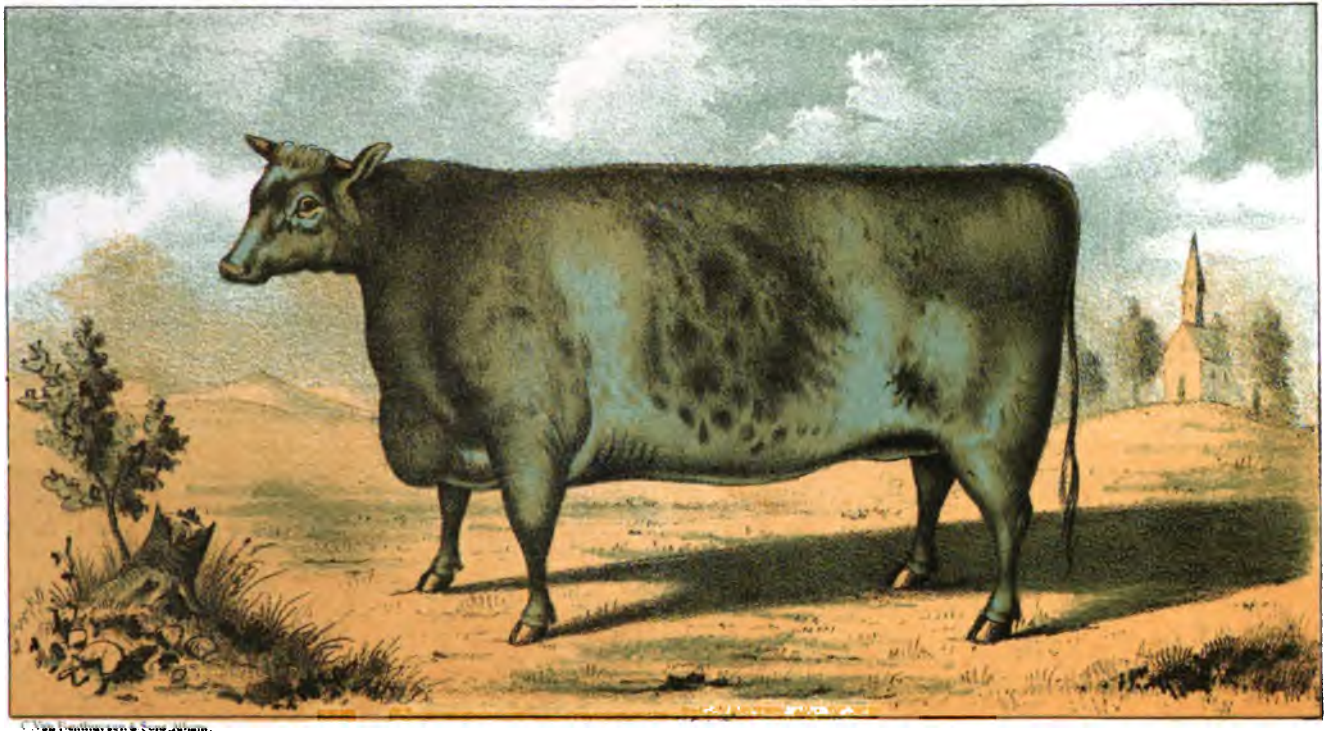

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KIRKLEAVINGTON, 12th

Finest prize two year old heifer, State Fair, Buffalo Oct 1867

Bred by EZRA CORNELL, Ithaca NY Sired by Thorn L. of Oxford, 4958 Dam Kirkleavington 11th

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TRANSACTIONS

OF THE

New York State Agricultural Society.

REPORT OF THE EXECUTIVE COMMITTEE.

To the Legislature of the State of New York:

THE Executive Committee of the New York State Agricultural Society most respectfully REPORT:

That the condition of the State, as reported to the Society, is most gratifying. Although the season has been in some respects unfavorable, yet, upon a review of the whole season, the farmers have secured a satisfactory harvest; and the price which has been realized for all the products of the farm, has placed this interest in a very prosperous condition. It cannot be doubted that, taken as a whole, the agriculturists in our State are improving. Taking the State together, it may safely be said, the year has been one of progress.

TRIAL OF PLOWS.

At our last annual meeting the trial of plows was decided to be undertaken, and arrangements were made for the trial in May, at the city of Utica. The Executive Committee, the judges and the competitors met in May, and all the arrangements were prepared, but the state of the weather was such that a trial could not be then had, and the trial was postponed until September.

The trial was had at Utica, in September, upon the lands of John Butterfield, Esq., which were freely offered for the trial. The utmost care was taken on the part of the judges, and every implement was thoroughly tested, and all the exhibitors were satisfied with the trial. The judges devoted much time in preparing for the decision of the merits of the various implements on trial; and the awards, as made by the judges, are hereto annexed:

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PLOWS.

CLASS I. SOD PLOW FOR STIFF SOILS.—The judges unanimously awarded the Gold Medal to F. F. Holbrook, Boston, Mass., for his Plow, 95.

CLASS II. PLOW FOR STUBBLE LAND IN STIFF SOILS.—The Gold Medal awarded to F. F. Holbrook, Boston.

CLASS III. SOD PLOWS FOR SANDY SOILS AND LIGHT LAWNS.—No trial in this Class.

CLASS IV. PLOW FOR STUBBLE LAND, cutting a furrow twelve inches deep, with three horses, and raised the lowest soil to the surface of the furrow—furrow five inches wide.—Unanimously awarded the large Gold Medal to F. F. Holbrook, Boston, Mass.

CLASS V. MICHIGAN SOD AND TRENCH PLOW.—Unanimously awarded the Medal to F. F. Holbrook, Boston, Mass.

CLASS VI. SUBSOIL PLOW, IN CONNECTION WITH AN ORDINARY PLOW.—None of the plows offered are worthy of a premium.

CLASS VII. DITCHING PLOW FOR OPENING DRAINS.—Unanimously awarded the Gold Medal to N. Hawks, Appleton, Maine.

CLASS VIII. MACHINE FOR EXCAVATING DITCHES FOR UNDERDRAINING.—Edwin Heath, Fowlerville, Livingston county, Gold Medal. Unanimous.

CLASS IX. STEEL PLOW FOR ALLUVIAL AND UNCTUOUS LANDS.—Gold Medal to Collins & Co., New York. Unanimous.

CLASS X. SWING OR SIDE HILL PLOW.—No award. Judges equally divided.

HARROWS.

BEST HARROW.—J. E. Morgan, Deerfield, Oneida county, Gold Medal.

The judges recommend a special premium of a Gold Medal to F. Nishwitz, Williamsburgh, for his Pulverizing Harrow.

CULTIVATORS.

CLASS I. FOR CORN AND ROOT CROPS. ONE HORSE CULTIVATOR.—Alden & Co., Auburn, Gold Medal.

CLASS I. TWO HORSE CULTIVATOR, FOR CULTIVATING TWO ROWS.—To Phipper, the inventor (the machine being entered by A. L. Brearley & Co., Trenton, N. J.), Gold Medal.

CLASS II. FOR MELLOWING SOIL AND KILLING WEEDS.—Gold Medal to Ford & Howe, Oneonta, N. Y.

BEST CULTIVATOR HAVING HANDLES.—Wm. H. Burtis & Co., Maltaville, Saratoga county, Gold Medal.

The awards on Harrows and Cultivators are all unanimous.

The chairman, John Stanton Gould, is devoting his time in the preparation of his report. His researches reach most of the civilized countries, and will prove one of the most valuable reports ever published in this country, and which will prove of great importance to the farmers of our country. As Mr. Gould is preparing his report for publication in the Transactions of the Society, we shall close our remarks on this subject further than to state that Mr. Gould is now engaged in the examination and history of

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plows, not only in our own country, but in all parts of the world to which access can be had, and it doubtless will prove the most valuable report yet made on this all-important subject. Much interest is manifested for the completion of the report, and it will be issued as soon as its importance demands

ABORTION.

It will be recollected that at our last annual meeting the subject of *abortion* was brought before the Society, and was fully examined, and the Executive Committee was directed to make application for the funds, to the Legislature, to enable them to discover, if possible, the cause of this disease, and a remedy for it.

The application to the Legislature was successful, and five thousand dollars were appropriated, which, with a thousand dollars in the treasury of the Society, made the sum of six thousand dollars devoted to this effort to relieve the dairy interest of the severe scourge now prevailing in an extensive portion of the dairy district.

An able corps of scientific men were selected, and they have been making their investigations and monthly reports, an abstract from which has been presented, and will be incorporated in this report. The investigations were very thorough—and it has learned the methods of dairy farming pursued in different sections of the country, and by no means least in importance; it has brought directly to the knowledge of the farmers the fact that such investigation is in progress, and reminded them of the importance of more care, on their part, in keeping records of the herds, the absence of which has been a matter of serious inconvenience. As Dr. Dalton is to speak on this, we shall omit the remarks intended.

"The commission does not understand that at the present time a full report of the results of this investigation, or of the opinions formed, is requested; nor, indeed, is it prepared to give such a report. The time has been too limited to permit them to do much more than to assign, broadly, the limits within which the disease prevails. The reports from the farmers themselves, though evincing much interest in the subject, have not been full enough to authorize the commissioners to form conclusions on many points necessary to a full understanding of the subject; though it also desires to express gratification at the interest manifested by farmers, and at the evident desire displayed to assist in the investigation. It is, therefore, necessary to get full and more accurate

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reports, which can only be accomplished by personal inspections made by fully qualified inspectors, who, as above stated, are now engaged in that labor. More inspectors will be added during the winter, as it is desirable that the districts most severely affected, should be thoroughly inspected; and the intention is to keep the inspectors in the vicinity thereof, during the coming winter, especially so, as there have thus far been no opportunities offered for actual examinations of any of the products of the abortion. This has arisen from the fact that the abortions actually occur, or at any rate are usually found, during the winter months of December, January, February and March, during the fifth, sixth, seventh and eighth months of utera gestation, or while the cows are stabled or confined in yards. Until these examinations are made, a very important item in the investigation is wanting, and an opinion given at this time, as to the nature of the difficulty, would be premature. Neither is it desirable to attempt a classification by the inspectors, until all the materials upon which it is to be based have been received; and as the inspectors are still engaged in their examinations, any such classification would now be imperfect. The commission is, however, sufficiently well satisfied with the results so far obtained. It now knows where the disease is most prevalent; it is able to prosecute inquiries with more distinctness, being able to avoid superfluous questions that at first seemed of importance; it has learned the methods of dairy farming pursued in different sections of the country, and by no means least in importance; it has brought directly to the knowledge of farmers the fact that such an investigation is in progress, and reminded them of the importance of more care, on their part, in keeping records of the herds, the absence of which has been a matter of serious inconvenience. Eight hundred and nine farms were examined to the twelfth of November; and the way is now being opened which will lead, it is believed, to most important results. Farmers are becoming satisfied that these investigations are designed for their benefit, and will, if fully carried out, prove all-important to the dairy interest of our State. Dr. Dalton, who has the charge of these investigations, and will be present at the meeting, will give in detail the investigations which have been made."

RINDERPEST.

The act of the Legislature, appointing a commission to prepare for this terrible disease, should it appear among us, expired at the

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last session of the Legislature, and was extended for the term of three years.

Gen. Patrick, Lewis F. Allen and Hon. William Kelly were the original commissioners. Mr. Kelly resigned, and J. Stanton Gould was appointed in his place. The commissioners reported to the Governor the proceedings which they have had, and Governor Fenton has referred the report to the Legislature.

DEATH OF EX-PRESIDENT JOHN A. KING.

At a meeting of the Executive Committee, at Buffalo, July 10th, L. F. Allen, ex-President, announced the death of John A. King, ex-President, and moved the appointment, by the President, of a committee to report resolutions on the death of ex-President King, at the next meeting. Lewis F. Allen, J. Stanton Gould and Luther H. Tucker were appointed the committee.

At a subsequent meeting of the Board, Mr. Allen, chairman of of the committee, made the following report:

MR. PRESIDENT: A deep calamity has fallen upon us in the decease of the venerable John A. King, late a President and one of the Board of Councillors of this Society, and for twenty-five years one of its active, valued and honored members. While we humbly bow to this afflictive dispensation, it is becoming that we record our testimony to his private worth, to the value of his services to our Society, and to his labors for the public welfare.

Governor King lived to the verge of fourscore years. In early life, as a soldier in its armies, he served his country in the war of 1812–15 with Great Britain; afterwards, in its foreign diplomacy, as a member of the American Legation at the Court of St. James. In his maturer years he repeatedly represented his county and senatorial district in both houses of our State Legislature. He was elected a member of our National Congress, and closed his public life as Governor of the State of New York. In all these highly responsible trusts he was distinguished by an apt ability, unfaltering patriotism, unblemished honor, and spotless integrity, and an enemy to none; he was an ardent, sincere and attached friend to all who sought and shared his esteem.

But it is of his connection with our Society that we have chiefly to speak. His tastes for agriculture were early developed. Throughout his life, amid all his private and public engagements, he was ever a farmer, delighting in the cultivation of his acres; and, with the farmers of his county and State, for more than fifty

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years he was intimately and happily associated—always for their advancement and welfare. With us, on all necessary occasions, as opportunity permitted, his geniality cheered, his wisdom enlightened, his labors gave energy to our action. No subject, no duty was beneath his attention; and at all times when present, his services were promptly and faithfully rendered. While presiding over our deliberations his judgments were sound, his decisions just. Urbane in manner, affable in his intercourse with all, his presence reflected dignity on our Association, whose highest usefulness and welfare he cherished.

Elastic in temperament, buoyant in spirit, ever mindful of duty, Governor King was useful to the last. The torpor of age had not reached, nor physical infirmity enfeebled him. He died in the harness.

So late as the month of September last, at our annual exhibition at Saratoga, at the advanced age of seventy-eight years, in addition to various other official engagements, he discharged, with his accustomed promptitude, his duties on an important committee with which he had for several years been associated. On the late anniversary of our National Independence, while addressing a literary society of young men in the village of his residence, exhorting them, as was his wont, to lives of usefulness and honor, he was stricken with paralysis, and carried, helpless, to his home. Surrounded by his afflicted family and friends, after three days of suffering, in the full possession of his mental faculties, under the consolations of religious faith, and in the hopes of an immortal resurrection, he painlessly died.

Your committee respectfully submit the following:

Resolved, That we deeply mourn the death of the Hon. John A. King, long associated with us as a member and President, and one of the Councillors of this Society. In him the agricultural interests of the country have lost an ardent friend and supporter, the community a valued and useful citizen.

Resolved, That we tender to the widow and family of the deceased, our deep sympathy in their afflictive bereavement.

Resolved, That the Hon. John Stanton Gould prepare a memorial of the services of Gov. King to this Society, to his country and the State, and to his worth as a citizen in public as well as in private life, and that the same be read before this Society at its annual exhibition at Buffalo in October next.

Resolved, That this paper be entered on the journal of the Society, and a copy thereof be transmitted to the family of the late Governor King.

(Signed.) L. F. ALLEN.

In accordance with the resolution directing the Secretary to furnish the family of the late Gov. King with a copy of the report

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of the Board, a copy of the proceedings of the committee were furnished to the family of Gov. King, and the family returned their cordial thanks for the testimony given to their deceased relative and friend.

During the progress of the Fair at Buffalo, ex-President Gould delivered an eulogy upon ex-President John A. King. The court-room, where the meeting was held, was crowded to its utmost limit—and the eulogy of Mr. Gould was a most affecting discourse, which reached every heart—and at its close, a member moved the adjournment of the Society, as, after such an eulogium, the people were not prepared for further business.

A motion to print the eulogy was unanimously passed, and the extent to which this able and affecting address has been called for, exceeds any address which the Society has published.

EVENING MEETINGS,

During the Fair, were held, and the discussions were of very great interest. October 1st, the question was: "*Has not the culture of the apple occupied as much of our State as is profitable?*"

Major H. W. Brooks, of Wyoming county, read an able and elaborate essay on the profits of the apple culture; and the discussion was one of great interest, and will doubtless lead to an extension of the culture of fruit in different portions of our State. Major Brooks will furnish his address for publication in the Transactions, and it will be productive of much good.

SCALE OF POINTS USED IN TESTING THE HERDS OF SHORT HORNS.

Lewis G. Morris, Samuel Thorne and D. B. Haight, *Judges.*

In compliance with the request of the Society, directing the judges to judge short horned cattle, by using the *Scale of Points* as furnished in printed form, we have the honor to submit the following report as the result of our labors at the Fair held at Buffalo, October, 1867.

Accompanying their report is a full statement of the examination of each animal, showing the comparison made between each in every point, the result of which was arrived at by adding up the columns.

The judges do not presume to say that their judgment is positively correct in each and every scale of points, as contrasted and applied; but so far as their judgment and belief directed them, they are in the main correct.

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The judges, after having "dissected" each animal, tested their judgment upon them, according to the former method, before they left the ring, and were well satisfied that the mathematical result was a correct one.

We believe, if judges can be obtained who are willing to *devote the requisite time* to the subject, the method of examination by the scale of points will be a benefit to the cause. We could recommend, if desired, some changes in the forms of the blanks furnished.

The full report made by Mr. Willard, and that of the committee on Short Horns, is given with the report of the Society.

The Annual Fair of the Society was one of deep interest. The exhibition of stock, and of machinery and implements, was peculiarly attractive, and the report of X. A. Willard, which has been published, shows this to have been one of the most interesting exhibitions ever held by the Society; and the exhibitors at Buffalo and from the adjacent counties have done themselves great credit in sustaining this exhibition.

We have not time to detail the various superior animals exhibited. Cattle, sheep and swine were of very great excellence, while some of the departments were not in all respects equal to those referred to.

PREMIUM LIST.

The Society has long felt the need of a new list of premiums. A committee was selected for that purpose, and it was expected a report would be in readiness at this meeting. It has been commenced, and must be left to our successors to complete. Every effort in our power will be put in requisition to have this list completed in time for distribution; and we would desire that members of the Society should aid us in this work.

MANUAL.

A committee was appointed to prepare a manual for our show grounds and erections for our fairs. Progress has been made, and a report will soon be presented that, it is believed, will accomplish all that is desired.

COUNTY AND TOWN AND UNION ASSOCIATONS.

The returns which have been received show a most encouraging advance in many of the Societies; and our farmers are alive to their best interests, and are making most gratifying progress in all

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that relates to the improvement of the farm. Not only are our farmers giving increased attention to the cultivation of the soil, and adopting improvements which are of great importance, but in the breeding of stock adapted to their wants, of such improved quality as gives us the assurance that we shall soon be prepared to show to the world that we can produce as fine cattle, horses, sheep and swine as are to be found in any country.

A distinguished breeder of our own State has sent to England, American stock which commanded extraordinary prices in Great Britain; and this will continue.

The prejudice which has so long prevailed among a large class of our farmers against improving their stock, is fast giving away, and it is believed we shall show to the world that America can do all that other countries may need.

Our great dairy interest is organized to develop the great work entrusted to it; and the advance made in this department promises the most gratifying results. The idea that no improvement can be made is abandoned, and we are yearly adding to the number of those who make butter and cheese which cannot be excelled, and that, too, at an expense not greater than is required to pursue the beaten track of olden time.

A large field is still to be occupied, and we trust that the interest now awakened will continue to spread until we shall add largely to the resources of our State. Among the cheering accounts which reach us are the inquiries: How shall we best increase the products of our dairies? Shall we improve our cattle, or shall we go on as we have done in too many instances heretofore, without making an effort to advance?

These questions are being discussed by practical farmers, and the results of these discussions must be salutary.

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THE ANNUAL MEETING OF THE SOCIETY.

ALBANY, *February* 12, 1868.

The Society convened, in pursuance of notice, at the Assembly Chamber, Albany, on the 12th instant, President M. R. Patrick in the chair. The first business in order was the reading of the Treasurer's report, which was of greater length than usual, reviewing the receipts and expenses of the past ten years, and stating in detail the several appropriations made by the State for agricultural purposes during that period.

REPORT OF THE TREASURER.

It may be well for the Treasurer, in submitting his Tenth Annual Report, to connect therewith a brief review of the financial operations of the Society since he has been associated officially in its management, in order to show more fully than can be done in the report of any single year, precisely upon what objects its money has been expended, and from what sources it has been obtained. In this review the past ten years alone are included, instead of the whole period since the Society's organization, because the books in the possession of the present Treasurer only extend back to 1858, and because, although the whole financial history of the Society would be on some accounts more interesting, ten years will nevertheless constitute a period long enough, it is believed, to show a fair average of what is here accomplished. Indeed it may be exceedingly unfair to take *a single year* as representing the movements of our treasury, if it happen to be a year of unusual loss or unusual gain, of lessened expenses in one direction or increased burdens in another. We must embrace a number of years together, to ascertain correctly the basis on which we are working, and the work we are performing.

Before proceeding farther, it is desirable to state, with the utmost explicitness, the extent to which the Society's treasury is the recipient of appropriations from the public funds. Down to 1862, the Legislature of the State devoted eight thousand dollars a year ($8,000) to be divided among all her agricultural societies, and in that year increased the gift to ten thousand dollars ($10,000). Of this sum the State Agricultural Society's share was seven hundred dollars ($700) a year, previous to 1862—since that time it has

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been eight hundred and seventy-five ($875) a year. The rest of the fund goes to other societies, and is drawn by them directly from the State. It does not come into our hands, and with its use or distribution we have nothing to do. And the amount just specified ($875 a year) is the *entire and only amount* now received from the State by the treasury of the Society, *applicable to its general uses.*

There have been some *special appropriations*, however, placed in our hands for certain objects, which the Society has rceeived and disbursed without cost to the State or pecuniary benefit to itself. Of these the only one that has been continued from year to year, is the sum wisely devoted by the State for the salary of Dr. Asa Fitch, in partial remuneration for the constant investigations in which he is engaged in the important science of Entomology. This sum has been $1,000 a year, until the year beginning with the first of October last (1867), from which date it has been advanced to $1,250; it is drawn quarterly from the Comptroller, and paid over, as soon as drawn, directly to the Entomologist. The other special appropriations received by the Society, and what has been done with them, follow, in the order in which they occurred:

1. In the year 1862, the sum of two thousand dollars ($2,000) was appropriated by the Legislature to encourage the improvement of flax machinery. No claim having been presented to which the Executive Committee considered themselves at liberty to make an award under the reading of the law, and the special reasons for the offer having apparently passed by, this sum, together with $241.47, accrued interest (total $2,241.47), was returned to the State treasury during the past year. The fund had been meantime on deposit with the U. S. Trust Company of New York, and a portion of the interest received upon it was expended in investigating numerous claims to the award which were presented from time to time to the Society—for which expenditure duly certified vouchers have been submitted with the Treasurer's annual reports, so that the whole sum, principal and interest, has been fully accounted for.

2. In the year 1863, the sum of one thousand dollars ($1,000) was appropriated by the Legislature, to meet certain expenses incurred by citizens of the State in securing a representation of our products and inventions at the International Exhibition held at the city of Hamburg; and this sum, like the preceding, was

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placed in the custody of the State Agricultural Society for disbursement. The amount actually required, under a strict construction of the law, proved to be only $668.38, and the Executive Committee were about to return the unexpended balance, when an act was voluntarily passed by the Legislature, devoting this balance to certain needed improvements in the room occupied by the Society's library, and it was thus expended during the year 1864, in accordance with law.

3. In the year 1865, the sum of five thousand dollars ($5,000) was appropriated by the Legislature, to enable the Society to hold a National Trial of farming implements and machinery. It was too late to make satisfactory arrangements that season, and the money was invested, as soon as drawn, in bonds of the United States. In the succeeding year, 1866, one branch of the trial, embracing harvesting machinery, was held at the city of Auburn; and during the past year, 1867, a second branch of the trial, embracing implements of tillage, has taken place at the city of Utica. To these two trials, the principal and interest of the fund have been devoted; and out of both, there remains now unexpended only $252.90, or no more than will be required to meet outstanding obligations. The receipts and expenses of these trials are fully accounted for in the present and preceding reports of the Treasurer.

4. In the year 1866, the sum of one thousand dollars ($1,000), and in the year 1867 the farther sum of five thousand dollars (total $6,000), were appropriated by the Legislature, to meet the expenses of a thorough investigation into a difficulty which has become the scourge of our dairying counties—the prevalence of abortion in cows. A first installment of these appropriations was drawn by the Society in May last, of $2,000; and a second of the same amount, January 18, 1868—making a total of $4,000 so far received by our treasury. A commission was appointed in charge of the investigation, who have been and now are actively engaged in its prosecution. The sum required to meet the expenses of the undertaking thus far, including, with the amount disbursed in 1867, a small amount expended in 1866, and shown by the Treasurer's account in that year, has been $4,048.86, or $48.86 in advance of the Society's drafts upon the State.

This comprises a full list of the special appropriations made to the Society by the State, during the past ten years. With what degree of economy and judgment they have been employed for

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the purposes for which they were severally intended, it is for others to determine from the published reports that have appeared or are still to be prepared. The present design is merely to show the aggregate of the amounts received, and in what manner, financially, they have been administered. As these sums were exceptional in their nature, and have only passed through the Society's treasury in transit, they may properly be omitted in a general statement of those financial transactions coming within the Society's regular sphere of operations.

The Society's only *resources*, then, are its receipts from life and annual memberships; the amount taken in at its annual exhibitions; the general State appropriation (now $875 a year); a few occasional donations; sales of duplicates from its library, &c. (coming under the head of Miscellaneous), and the interest it receives on any funds it may be able to accumulate. The income from these sources for the ten years, 1858–1867, inclusive, shows the following annual average:

Average Receipts of the State Agricultural Society for each of the Ten Years, 1858–1867.

For annual memberships	$68 90
For life memberships	392 60
Appropriations from the State	805 00
Receipts at annual fair	12,938 38
Miscellaneous sources	117 38
Interest account	189 31
Total average yearly income	$14,511 57

The Society's *expenses* are not confined to those incurred directly in holding the annual exhibition. Aside from the offering and paying of prizes, then and at the annual meeting in February, and the outlay required in superintending these great gatherings of the public, its annual volumes and other publications require no little editorial labor; its extensive correspondence must be carried on; it is accumulating a library and museum of great value, and it must hold itself in readiness for the discharge of any trusts that may be received from the State, in the management of which it has come to be the recognized agent so far as subjects connected with agriculture are concerned. It also constitutes a point of union for all the other agricultural organizations of the State, now about one hundred and fifty in number, whose proceedings it must receive and digest, and for whom, in fact, it must act as a sort of general agency at the Capital of the State. The salaries of those who do

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all this work come out of the Society's receipts from memberships and from its fairs; and taking bad years with good, as we shall see, there is little margin left, with the strictest supervision, beyond the actual meeting of current liabilities. Small as this margin is, it has enabled the Society to accumulate the nucleus of a fund, from the income of which it is hoped it may be able, at some future period, either to add materially to the attractions, or reduce materially the cost, of its annual exhibitions. For the twenty-seven years of its working existence, this margin has averaged less than $500 a year; for the nine years preceding 1867, it averaged about $300 a year; for the past ten years, including 1867, owing to unusual success in 1867, the average has been brought up to nearly $900 a year. In reality, however, the only savings of the Society may be said to arise *from its uncalled for premiums;* since the amount offered to public competition in its premium lists, if the competition elicited was sufficient to require the award and payment of the whole, is enough, it is believed, to wipe out the entire margin from which our accumulations have arisen, and leave our treasury with a balance on the other side. There is another point of view, moreover, from which our present financial condition may be regarded: If the current expenses of the Society could have been met from its current receipts from memberships and from its annual fairs (had these been adequate for the purpose), the $700 to $875 annually received from the State might have been laid aside toward securing a permanent fund, and the amount from this source alone (for principal only, throwing out any computation of interest) would now have been about $20,000, instead of less than $13,000, which our treasury actually contains. Just now we *are* averaging a saving of about the amount received from the State—offering it, however, as has been indicated, in premiums, which we are obliged to pay if they happen to be awarded, and thus holding out the full measure of encouragement for farm improvements and inventions which the limit of our means will allow.

With these preliminary remarks, the following statement of the average annual expenditures from the Society's treasury for the past ten years, is presented—corresponding to the table of average annual receipts already given:

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AVERAGE EXPENSES OF THE STATE AGRICULTURAL SOCIETY FOR EACH OF THE TEN YEARS, 1858–1867.

For premiums, &c., at winter meeting	$412 64
For premiums, &c., on account previous years	605 58
For salaries and traveling expenses	3,443 58
For library and museum	147 84
For printing, stationery, &c.	727 04
For postages	217 52
For incidental expenses	189 30
For premiums at State Fair	4,572 45
For expenses at State Fair	3,302 13
Total average yearly expenses	$13,618 08

PRESENT STATE OF THE SOCIETY'S TREASURY.

Average yearly income for ten years	$14,511 57
Average yearly expenses for ten years	13,618 08
Average yearly savings	$893 49
Assets of the Society February, 1868	$3,771 59
Added in ten years at the above rate	8,934 88
Amount now on hand	$12,706 47
Add amount on hand belonging to trial of implement fund, as already stated	252 90
	$12,959 37
Deduct advance to abortion investigating fund	48 86
Society's present assets as shown by the report	$12,910 51

It seems scarcely fair to enter into an analysis of the loss or gain to the Society resulting from the several years included above, one by one, without at the same time giving fuller details of the circumstances connected with or accounting for either, than would properly come within the limits of the present report. It has been the policy of the Society in the past, to carry its annual exhibitions to any place (in which there was reasonable hope of accommodating the public) where the interest of citizens was such as to lead them to unite in the usual invitation, without hesitation on the ground of possibly inadequate receipts, and solely with the view of giving all parts of the State, as far as practicable, an equal share in whatever benefits may result to the immediate districts in which these exhibitions are held. Our smaller as well as larger cities have been earnest competitors for them,—manifesting a degree of enterprise, good-will and public spirit worthy of the utmost consideration and commendation; and on some occasions clear skies and seasons of plenty in money or in crops. have seemed

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to co-operate in swelling the successes of the larger, or the lack of them to put unexpected obstacles in the way of the successes of the smaller. Of the ten years since 1857, four were years of loss, and six of gain; and in the future as in the past, unless the resources obtained in the one are husbanded with care, our financial credit cannot remain unimpaired by the reverses of the other. Once before, fifteen or sixteen years ago, the Society had laid by a fund of about the same amount it now possesses, the whole of which was subsequently swept away by a succession of unfavorable years.

These facts are dwelt upon the more particularly at this time, because, to those who are not familiar with them, it sometimes seems a miserly economy that the Society should fail to expend what it receives directly at the time and place in which its successes chance to occur. An explanation is also afforded of the reasons why the Society, on its present basis of operations, is compelled to require as a condition in locating its exhibitions that the locality seeking them should provide the necessary grounds, erections, &c., and assist in meeting the burden occasioned by some other kinds of expense. All the leading Agricultural Societies of Great Britain, Canada and the United States are conducted substantially upon the same plan in this respect, and, in comparison with the requirements they exact, those familiar with the subject must acknowledge that ours are not excessive. When it is remembered, moreover, that the forty, fifty, or sixty thousand strangers who are thus brought into a place within a single week, must expend there in other ways, very many dollars in proportion to the dimes they actually pay for admission to our grounds, it will be perceived wherein the profit to the citizens consists, and how much the amount brought into the place must exceed the comparatively trifling sum we carry from it. And this sum, it should be remembered, is distributed ultimately, if not at once, to all parts of the State; and as it has sometimes excited remark that so many of the Society's employees are strangers at the places where the Fairs are held, it may be added that they too are gathered from many different counties, and selected, without local prejudice or partiality, just as the Society, in the annual movements of its exhibitions, has been fortunate enough to find and able to retain the services of faithful and capable assistants.

The statement herewith presented for the year just concluded, is comprised in the following table:

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Treasurer's Account for 1867.

Receipts.

February 13, 1867.

Balance from last account	$9,292 39
Annual memberships received	56 00
Life memberships received	300 00
State appropriation to Society	875 00
State appropriation to Dr. A. Fitch	1,062 50
State appropriation to investigate abortion in cows	4,000 00
Flax fund, drawn from U. S. Trust Company	2,234 00
Receipts at State Fair at Buffalo	22,238 43
Duplicates of diplomas awarded	5 00
Duplicates of books and reports sold	32 46
Interest account	502 21
Total	$40,597 99

Disbursements.

Premiums, &c., at winter meeting		$298 15
Premiums, &c., of previous years		482 28
Flax fund returned to State treasury		2,241 47
Library and museum expenses		233 00
Salary of Dr. Asa Fitch, entomologist		1,062 50
Other salaries		4,400 00
Incidental expenses		256 38
Postages		277 10
Printing and stationery		1,297 51
Premiums, &c., at Buffalo fair		4,076 28
Expenses at Buffalo fair		4,770 34
Extra expenses, erections, &c		2,199 31
Implement trial fund account		2,106 55
Investigation of abortion in cows		3,986 61
Total		$27,687 48
Cash in bank to new account	$3,737 01	
U. S. securities, to new account	9,173 50	
		12,910 51
Total		$40,597 99

The schedules referred to in the table of disbursements contain the details as to each item of money paid out, with its accompanying voucher. Under the schedule entitled "Extra Expenses of Erections, &c. at the Buffalo Fair," the net amount stated is the difference which the Society assumed, between the aggregate expenses usually borne by the locality for buildings, fodder, &c., and the amount actually raised in the locality—the necessity of assuming this outlay having only become apparent to the Board at too late a period in the season to accept invitations from other

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points for a change of location. Had the pressure from prominent citizens of Buffalo themselves, at the time the invitation from that city was presented, been less earnest, it is probable that the Fair would have been originally located elsewhere. As it was, although some misgiving were felt at the outset by the Society, and possibly by a few of its friends at Buffalo, the Board could not yield to these fears without appearing to doubt the good faith of those citizens to whose hands the invitation was committed. To his Honor Mayor Wells, the Board is indebted for the honorable and manly way in which he discharged the duties of a difficult position, and shares the pleasure he expressed so heartily that an amicable and mutually satisfactory solution of the troubles by which at one time we were threatened, was finally obtained. The aggregate amount expended under this schedule was $9,957.81; the total amount raised by citizens of Buffalo, and turned over to the contractor, was $7,711, to which a small item of $47.50, for surplus forage sold after the Fair, is added, making the total deduction $7,758.50, and leaving our net expenditure $2,199.31, as already stated. But it should be added that this amount is likely to be enlarged by the settlement of a now outstanding claim by our contractor, for losses sustained in the tornado which occurred just before the Fair.*

A few words of explanation are also necessary with reference to Schedule L, which contains our account with the Implement Trial Fund. The expenses incurred were increased by the postponement of the trial from the date first appointed in the spring (owing to the almost unprecedentedly stormy character of the season) until September—a necessity which did not become apparent until the officers of the Society, with judges and exhibitors, had assembled at Utica, and spent some days in waiting for the cessation of the rains. The total cost of the whole, together with a number of bills paid on account of the Trial of the preceding year at Auburn, was $2,798.42, from which are deducted $104 for interest to the credit of this fund, $489.36 reported by the Secretary for entry fees, &c., and $98.51 for sales of Reports (total deductions $691.87), leaving the net expenses from this fund $2,106.55, as given in Schedule L. As the amount to its credit, from the Treasurer's

* This claim has been adjusted by the Executive Committee since the preparation of the Treasurer's Report, by the payment of $1,055—thereby reducing the Society's actual balance in hand by the amount thus paid, and diminishing accordingly the net savings of the year.—L. H. T.

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account of 1866, was $2,359.45, the residue of the funds now in our hands is $252.90—thus agreeing with a previous statement in this Report.

From what has been said, it is hoped that the financial bearings of the Society's position will be rendered sufficiently clear, both as to the present and the past. It has been the intention of the Treasurer to anticipate and answer every question that can arise, so that the present board can transmit to its successors in office a clear and explicit understanding of all their pecuniary transactions.

All of which is respectfully submitted.

LUTHER H. TUCKER,

ALBANY *Feb.* 12*th*, 1868. *Treasurer.*

REPORT OF THE EXECUTIVE COMMITTEE.

The Report of the Executive Committee was then read by Col. B. P. Johnson, Secretary. It spoke of the year as one of progress, and the condition both of the Society and of the Agriculture of the State as gratifying; stated the proceedings of the Society in relation to abortion in cows, and the rinderpest; mentioned, in fitting terms, the death of ex-President John A. King; stated the Buffalo Fair to have been one of the most interesting exhibitions ever held by the Society; and mentioned that there had been an encouraging advance made by the minor agricultural societies of the State.

On motion, the report was accepted and approved.

The following nominating committee was then appointed, on recommendation of the members present from the various Judicial Districts:

First District—L. G. Morris, N. P. Bailey, T. H. Faile, Jr. Second—W. Kelly, A. B. Conger, O. Judd. Third—Jurian Winne, Lewis Sherrill, Henry Waterman. Fourth—G. H. F. Van Horne, W. M. Holmes. Fifth—D. S. Heffron, J. Thomas, Jas. Geddes. Sixth—O. W. Chapman, N. Randall, A. B. Cornell. Seventh—J. O. Sheldon, H. T. E. Foster, J. G. Klinck. Eighth—E. L. Pitts, H. Bowen, R. Church.

This committee retired, and prepared the following report:

President—Thomas H. Faile, New York.

Vice-Presidents—First District, John Haven, New York; Second, Samuel Thorne, Dutchess; Third, Adin Thayer, Jr. Rensselaer; Fourth, Milo Ingalsbe, Washington; Fifth, Harris Lewis, Herkimer; Sixth, Wm. M. Ely, Broome; Seventh, H. T. E. Foster, Seneca; Eighth, George A. Moore, Erie.

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Corresponding Secretary—B. P. Johnson, Albany

Recording Secretary—Thomas L. Harison, St. Lawrence.

Treasurer—Luther H. Tucker, Albany.

Executive Committee—Richard Church, Allegany; James Geddes, Onondaga; S. T. Taber, Queens; L. D. Mitchell, Monroe; Wm. M. Burr, Jr. Madison; A. B. Cornell, Tompkins; R. F. Angel, Livingston; J. D. Wing, New York.

This report was adopted; and the officers nominated then elected. Recess.

ADDRESS AT THE EVENING MEETING.

The retiring President, Gen. Patrick, on taking the chair promptly at the hour named, opened with an interesting address, in which he first reviewed the peculiar features of the past year—referring particularly to the great drouth in many parts of the West, and suggesting greater attention to our consumption of timber as influencing the amount of rain-fall. In this State, all our valuable timber will be swept off in ten years at the present rate—except the great North woods. He then alluded to the changes in our systems of farming for six years past—the greatly increased use of machinery, the establishment of cheese factories, and the substitution of foreign for native-born farm laborers. Skilled native labor can now with difficulty be obtained. The cottage system would give some assistance in this respect—the men being married and boarding themselves. It also benefits the laborers; and this system, he believed, must extend from larger to smaller farms, until it is generally adopted. Times change, and we change with them. Some do not follow their fathers' footsteps, but are apt to leave the farm, and take other paths in life. Young men now show a growing distaste for honest, manly labor. Speculation, mining, petroleum, anything is more inviting. The recent war has had some agency in producing this state of things. Whenever labor ceases to be honorable in the eyes of any nation, the doom of that nation is sealed. Countries are cultivated not according to their fertility, but their freedom. Great changes have been wrought by railroads. Hundreds and hundreds of acres are added year by year to the small-fruit lands for this reason. Grape growing, pisciculture, the great dairy interest, the wool interest, and thoroughbred neat stock, are all growing in importance.

After some particular allusions to the Society's transactions in 1867, including a review of the Implement Trial at Utica, it was suggested whether the Society could not commit to some qualified

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person the duty of examining and reporting upon all new inventions brought to its notice, both as a measure of protection from humbugs, and as a mode of insuring more ready recognition of valuable inventions. The questions arising with regard to the Society's future policy, were then taken up; and in this, as on other topics, the address must be read in full to show the positions taken. It forms a very valuable contribution to the Society's annals, and was listened to with close attention—concluding with an introduction to the meeting of the incoming President, Mr. Thos. H. Faile, who very briefly and felicitously expressed his acknowledgments.

Mr. Elliott C. Cowdin, of New York, one of the commissioners in attendance at the Paris Exhibition, then gave a general review of that great event, presenting a graphic picture of the whole, with special details of the part taken in it by American contributors.

ABORTION IN COWS.

The report of Prof. Dalton on this subject was next in order. He said that, immediately after the appointment of the commission in April, they set about obtaining facts in regard to—

1. The location and extent of the disease.
2. Its history.
3. The kind of cattle attacked.
4. The management of infected farms.

Very valuable details of the facts and statistics collected by the commission were then given, showing the extensive correspondence carried on, and the very large number of farms actually visited by the corps of inspectors who were appointed.

This address will be published, giving a full account of the investigations of Dr. Dalton and his associates.

ALBANY, *February* 13.

The Executive Board held a session at the Agricultural Rooms, and premiums were awarded.

PREMIUMS AWARDED.

BARLEY.

A. W. Beach, Bristol, Ontario county: 4 6-10 acres; yield 250 6-14 bushels; grain sold for $1.40 per bushel—$350.61; straw, $30; total value, $380.61; cost of cultivation, $75.43; net profit, $305.18—Premium $15 00

WINTER RYE.

E. S. Hayward, Rochester; 2.78 acres; yield 109½ bushels; grain sold for $150.18; straw, $100.63; total, $259.81; cost of cultivation, $148.68; net profit, $111.13—Premium..... 15 00

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* HOPS.

Collins, Landon & Mooney, Brighton, Monroe county; 1071 hills, 7 feet apart each way; yield 1656 lbs. at 60c., $993.60; expenses, $80; net profit, $913.60; 1½ acres; Collins' Horizontal plan—Premium.. $15 00

GRAIN AND SEEDS.

Winter Wheat—W. P. Ottley, Phelps; weight 60 lbs.; 2d premium....	2 00
Spring Wheat—Henry Wier, Johnsonville, 56 lbs.; 2d premium.....	2 00
Winter Rye—1st premium, H. Schoonmaker, Cedar Hill, (White Michigan), 57 lbs.....	3 00
2d premium, E. S. Hayward, 57 lbs.....	2 00
Two rowed Barley—1st premium, W. P. Ottley, 50 lbs.....	3 00
2d premium, H. Wier, 46 lbs.....	2 00
Oats—1st premium, H. Wier, 39 lbs.....	3 00
2d premium, H. Schoonmaker, 30 lbs.....	2 00
Yellow Corn—1st premium, E. S. Hayward, 60 lbs.....	3 00
2d premium, A. E. Van Allen, East Greenbush, 58 lbs.....	2 00
Peas—1st premium, L. L. French, Richfield Springs, 61 lbs.....	3 00
2d premium, Henry Wier, 60 lbs.....	2 00
Beans—1st premium, L. L. French, 63 lbs.....	3 00
2d premium, A. E. Van Allen, 62 lbs.....	2 00
Clover Seed—1st premium, W. P. Ottley, 61 lbs.....	3 00
Buckwheat—1st premium, H. Schoonmaker, 51 lbs	3 00
2d premium, Henry Wier, 51 lbs.....	2 00
Flax Seed—1st premium, L. L. French, 50 lbs.....	3 00
2d premium, Henry Wier, 53 lbs.....	2 00
Sugar Cane Seed—1st premium, Henry Wier.....	3 00

DISCRETIONARY.

10 varieties Indian Corn, G. E. Spoor, Hebron.....	Trans.
12 varieties Indian Corn, H. Schoonmaker.....	Trans.

The committee had before them samples of Indian corn from the Hon. George Vail, Troy, Rensselaer county, former President of the Society, together with his statement, which in substance was, that he received the seed from the late Hon. Jesse Buel; that since the receipt of the seed he has cultivated it yearly ever since. The committee cannot but express the profound consideration hereby awakened in this living memento of the past, so carefully preserved so many years by the distinguished gentleman presenting the same. We therefore recommend the subject matter to the consideration of the Executive Committee.

OSCAR GRANGER,
A. OSBORN, *Committee.*

Thanks of the Board were presented to Mr. Vail.

BUTTER.

3 Tubs—J. S. Holbert, Chemung.....	$15 00
Jar Winter Butter—1st premium, M. E. Myers, Charlton.....	5 00
2d premium, O. Granger, Saratoga Springs.....	3 00
3d premium, J W. Collins, Greentown.....	Trans.

*Ordered, that the premium awarded to Collins, Landon and Mooney for the best half acre of hops be withheld until full statements are furnished.

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CHEESE.

3 Cheeses, M. E. Myers, Charlton, Saratoga county..... $15 00
Cheddar—F. W. Collins, Rochester, special premium recommended....
Small Silver Medal.

WINTER FRUITS.

20 varieties of apples—R. C. Brown, Greece, Monroe county..... 4 00
15 varieties, R. C. Brown..... 3 00
1 variety, (Tompkins Co. King)—R. C. Brown.....Small Silver Medal.

DISCRETIONARY.

Domestic Goods—21 specimens, Mrs. Henry Wier, special premium.... 10 00

Mr. Gould offered the following preamble and resolutions, which were adopted:

Resolved, That the State Agricultural Society having been a witness of the long years of skillful labor which the late Rev. Chauncey E. Goodrich devoted to the improvement of the potato and the multiplication of useful varieties, and certifying to the immunity which these new varieties have enjoyed from the ravages of disease, thus saving the farmers of the State from losses of millions of dollars, and as no adequate reward has been given by the State for his invaluable services, the Society earnestly request the Legislature to give some suitable reward to his dependent family in acknowledgment of the eminent service that he has rendered to the State.

Resolved, That the President and Secretary be requested to lay these resolutions before the Legislature, authenticated by their signatures and official seals.

The resolutions were executed, and the Hon. Samuel Campbell presented the same to the Senate.

Ordered, That an application be made to the Legislature for the sum of five thousand dollars to complete the abortion expenses.

Gen. Butterfield attended on behalf of the citizens of Utica, to solicit the location of the State Fair of 1868 at that city.

Communications were received from the President of the Monroe County Agricultural Society and Hon. N. C. Bradstreet, asking the Fair to be held at Rochester.

On motion of Mr. Sheldon,

Resolved, That the President, Secretaries and Treasurer be a committee to visit the places applying for the Fair, with power to select between them, and to obtain the necessary bonds, lease and agreement.

On motion,

Ordered, That five hundred copies of the address of the retiring

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President, and five hundred copies of Dr. Dalton's report on abortion be published in pamphlet form; and that an extra number of the Journal be issued with the Report of the Treasurer.

Mr. Orange Judd, of New York, appeared before the Committee, and read a communication tendering the sum of $300 to be offered on three prizes of $100 each, for the best barrel of white winter wheat, red winter wheat, and spring wheat growth of 1868, to be exhibited at the next state Fair, with 100 heads, stalks and roots —the condition of the quantity per acre to be stated.

On motion of Mr. Geddes,

Resolved, That the offer of Mr. Judd be received with thanks, and the details of the conditions, &c., be considered hereafter.

THE "ORANGE JUDD WHEAT PRIZES."

$300 WHEAT PRIZES—INTERESTING TO WHEAT GROWERS IN THE UNITED STATES AND CANADA.

At the suggestion of wheat-growers in Western New York, who desired to have special attention called to this subject at the Annual Meeting of the New York State Agricultural Society, February 12th, Mr Judd, of the *American Agriculturist*, brought the matter before the Executive Committee, and placed $300 at their disposal for prizes. The Committee accepted the offer with a vote of thanks, and they will annonnce the prizes for the next Annual Fair, probably in the form below, with, perhaps, slight variations that may be suggested while making out the official premium list. We call attention to the subject now, and give the preliminaries, that farmers may have an eye to the prizes in preparing for their spring wheat crops, and also in looking after their winter wheat now in the ground. The prizes themselves are large, but aside from these, the credit of carrying off the premium at the hands of the Empire State Society, the largest one in the country, will be worth competing for.

Best two barrels of white winter wheat	$100
Best two barrels of red winter wheat	100
Best two barrels of spring wheat	100

To be exhibited at the next Annual Fair of the New York State Agricultural Society (1868) under the rules and regulations of the Society. The committee of award to include at least one experienced, practical miller. Each sample to be accompanied by 100 stalks from the same field, with heads and roots complete, and also by a reliable written statement, properly verified, and con-

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firmed by two creditable witnesses, giving the name of the variety and source of the seed; the size of the field, the character of the soil, and the crops and manures on the same for four years past; the depth and mode of preparing the ground, and the time and mode of sowing and harvesting; the precise method of selecting and cleaning the samples; and any other particulars that may suggest themselves to the exhibitors.

The written statements to be taken into account in making the award. The written statements, and the three samples receiving the prizes to be the property of the Society. All other samples to be sold at auction during the Fair for the benefit of the exhibitors when desired.

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AWARD OF PREMIUMS.

TWENTY-SEVENTH ANNUAL FAIR, HELD AT BUFFALO, OCTOBER 1, 2, 3, 4, 1867.

SHORT HORN CATTLE.

Herd prize for Short Horns; the Society's Large Gold Medal; Ezra Cornell, Ithaca, N. Y.

Bull "Fidget's Oxford;" bred by Ezra Cornell; got by 3d Lord Oxford (22200); dam Fidget 5th, by Delhi (15865).

Cow "Lucilla;" bred by Ezra Cornell; got by Duke of Oxford 2780; dam Lucy Ann, by Cunningham (12671).

Heifer "Princess 16th;" bred by Ezra Cornell; got by St. Valentine, 4348½; dam Princess 12th, by Orion, 1964.

Heifer "Kirkleavington 12th;" bred by Ezra Cornell; got by 3d Lord Oxford (22200); dam Kirkleavington 11th, by Delhi (15865).

Heifer "Lucia;" bred by Ezra Cornell; got by 3d Lord Oxford (22200); dam Lucinda, by Young Renick, 4524.

Heifer calf "Lucy Curd;" bred by Ezra Cornell; got by Kirkleavington, 5860; dam Lucy Ann, by Cunningham (12671).

Heifer calf "Lucy Conkling;" bred by Ezra Cornell; got by Kirkleavington, 5860; dam Lucinda, by Young Renick, 4524.

REPORT OF JUDGES OF SHORT HORNED CATTLE.

Hon. B. P. JOHNSON, *Secretary of the N. Y. State Agricultural Society:*

Dear Sir—In compliance with the request of the Society, directing us to judge short horned cattle by using the scale of points as furnished in printed form, we have the honor to submit the following report as the result of our labors at the fair held at Buffalo, October, 1867:

The entrances were few in number, and consisted of six bulls, three years old and upwards; one bull, two years old; one bull, one year old. No bull calves were entered. The following is the result of our examination:

BULLS.

Three Years Old and Upwards.

1st prize, "Fleur de Lis' son of 2d Duke of Thornedale (17748)" (entrance number 84), the property of Hon. A. B. Conger, Waldberg, Rockland county, N. Y. Meritorious points, 774.

2d prize, "Grand Duke of Moreton" (entrance number 10), the property of F. W. Stone, Esq., of Guelph, C. W. Meritorious points, 731.

3d prize, "Grandson of Red Rose" (entrance number 83), the property of Hon. A. B. Conger, Waldberg, Rockland county, N. Y. Meritorious points, 708.

Entrance number 122 was not examined, because no pedigree was furnished.

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FIDGET'S OXFORD 5640

First prize two year old Bull at State Fair, Buffalo Oct. 1867

Bred by EZRA CORNELL, Ithaca, N.Y., Sired by Third Lord Oxford, 4956 Dam Fidget 5th

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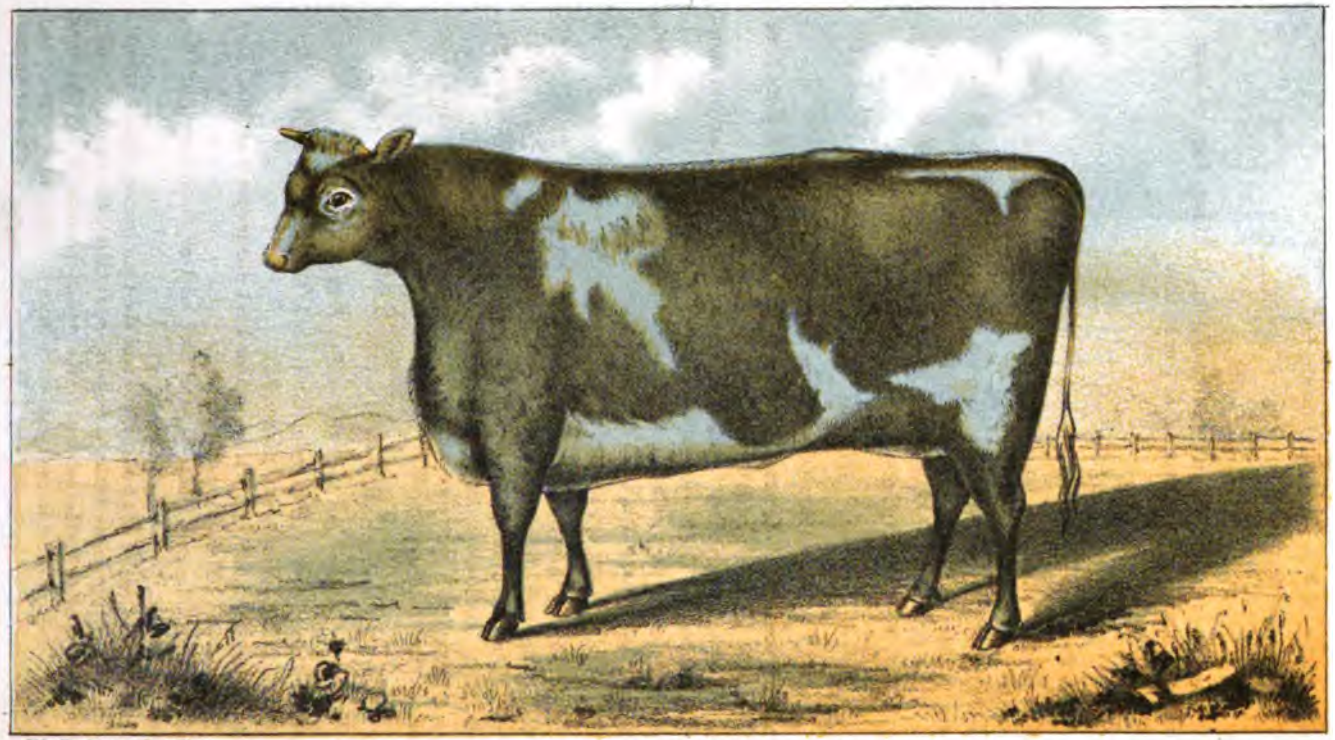

C. Van Benthuysen & Sons, Albany.

LUCY CURD.

First prize heifer calf, State Fair, Buffalo, Oct 1867.

Bred by EZRA CORNELL of Ithaca, N.Y., Sired by Kirkleavington, 5860. Dam Lucy Ann.

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Two Years Old.

1st prize, "Fidget's Oxford" (entrance number 108), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 860.

There were none others entered.

One Year Old.

1st prize (entrance number 29), the property of John D. Wing, Esq., of Washington, Dutchess county, N. Y. Meritorious points, 699.

None others entered.

COWS.

Three Years Old and Upwards—(Seven Entries).

1st prize, "Lucilla" (entrance number 109), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 879.

2d prize, "Yucca" (entrance number 81), the property of Hon. A. B. Conger, of Waldberg, Rockland county, N. Y. Meritorious points, 826.

3d prize, "Amethyst" (entrance number 123), the property of J. & S. Kinsey, of Darien, N. Y. Meritorious points, 816.

HEIFERS.

Two Years Old—(Three Entries.)

1st prize, "Princess 16th" (entrance number 110), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 907.

2d prize, "Kirkleavington 12th" (entrance number 110), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 906.

3d prize, "Myrica" (entrance number 79), the property of Hon. A. B. Conger, Waldberg, Rockland county, N. Y. Meritorious points, 806.

One Year Old—(Three Entries).

1st prize, "Lucia" (entrance number 112), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 922.

2d prize, "Hope" (entrance number 20), the property of Walcott & Campbell, New York Mills. Meritorious points, 869.

3d prize, "Myrica 2d" (entrance number 80), the property of Hon. A. B. Conger, Waldberg, Rockland county, N. Y. Meritorious points, 750.

HEIFER CALVES.

Under One Year Old—(Two Entries).

1st prize, "Lucy Curd" (entrance number 114), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 915.

2d prize, "Lucy Conkling" (entrance number 113), the property of Hon. Ezra Cornell, Ithaca, N. Y. Meritorious points, 882.

We have awarded the gold medal, for the best herd of short horns, to Hon. Ezra Cornell, of Ithaca, N. Y.

Accompanying this report is a full statement of the examination of each animal, showing the comparison made between each in every point, the result of which was arrived at by adding up the columns. We do not presume to say that our judgment is positively correct in each and every scale of points as contrasted and applied, but, so far as our judgment and belief directed us, we are satisfied that we are in the main correct. After having "dissected" each animal, we tested

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our judgment upon them according to the former method, before they left the ring, and were well satisfied that the mathematical result was a correct one.

We believe, if judges can be obtained who are willing *to devote the requisite time* to the subject, the method of examination by scale of points will be a benefit to the cause. If desired, we could recommend some changes in the form of the blanks furnished.

Respectfully submitted.

L. G. MORRIS,
SAMUEL THORNE,
D. B. HAIGHT.

BULLS, THREE YEARS OLD AND UPWARDS.

		Entrance Nos.				
	Points.	10	83	82	84	136
Head	30	15	25	22	28	25
Face	20	10	15	15	18	15
Eye	20	10	16	15	15	15
Horn	10	8	8	8	8	8
Neck	20	15	18	16	20	18
Chest	140	130	115	70	130	65
Brisket	50	30	35	35	40	20
Shoulder	40	40	20	20	30	35
Crops	80	75	65	60	70	75
Back, loin and hips	80	75	65	40	65	40
Rumps	50	40	30	25	45	20
Pelvis	20	....	....	....	....	....
Twist	30	30	15	20	15	15
Quarters	50	45	25	25	40	25
Carcase	40	35	20	20	35	25
Flanks	30	15	20	20	25	15
Legs	20	18	16	10	20	15
Plates	30	25	25	20	25	25
Tail	20	20	10	8	15	15
Carriage	20	8	15	10	10	10
Quality	150	75	125	125	105	100
Coat	20	12	18	15	15	10
Udder	30	....	....	....	....	....
	1,000	731	708	599	774	591

BULLS, TWO YEARS OLD AND UPWARDS.

	Ent. No. 108	
	Points.	
Head	30	25
Face	20	15
Eye	20	12
Horn	10	8
Neck	20	18
Chest	140	130

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	Ent. No. 108 Points.	
Brisket	50	50
Shoulder	40	35
Crops	80	75
Back, loin and hips	80	80
Rumps	50	40
Pelvis	20	....
Twist	30	25
Quarters	50	45
Carcase	40	40
Flanks	30	25
Legs	20	10
Plates	30	25
Tail	20	15
Carriage	20	12
Quality	150	140
Coat	20	15
Udder	30	....
	1,000	860

BULLS, ONE YEAR OLD.

	Ent. No. 29 Points.	
Head	30	25
Face	20	15
Eye	20	15
Horns	10	5
Neck	20	17
Chest	140	100
Brisket	50	40
Shoulder	40	35
Crops	80	70
Back, loin and hips	80	50
Rumps	50	35
Pelvis	20	....
Twist	30	20
Quarters	50	40
Carcase	40	20
Flanks	30	25
Legs	20	15
Plates	30	20
Tail	20	10
Carriage	20	17
Quality	150	110
Coat	20	15
Udder	30	....
	1,000	699

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COWS, THREE YEARS OLD AND UPWARDS.

		Entrance Nos.						
	Points.	109	123	73	81	77	124	85
Head	30	30	25	15	30	12	25	15
Face	20	20	20	10	20	8	20	10
Eye	20	18	18	15	20	15	20	15
Horn	10	10	8	5	10	3	8	5
Neck	20	18	18	15	18	10	18	10
Chest	140	140	130	120	130	120	120	115
Brisket	50	50	50	35	50	35	30	30
Shoulder	40	35	30	35	35	20	35	20
Crops	80	80	50	65	60	55	65	40
Back, loin and hips	80	70	65	70	70	65	70	40
Rumps	50	25	30	40	40	40	35	25
Pelvis	20	....	....	....	....	....	....	....
Twist	30	20	30	30	20	20	25	20
Quarters	50	40	45	45	40	35	40	25
Carcase	40	40	35	35	30	30	30	20
Flanks	30	25	25	25	15	20	20	15
Legs	20	18	15	18	15	20	15	15
Plates	30	30	20	30	25	25	20	15
Tail	20	15	10	15	18	15	18	18
Carriage	20	18	15	18	18	15	15	10
Quality	150	140	140	130	120	115	115	140
Coat	20	17	17	18	17	15	15	17
Udder	30	20	20	20	20	15	20	20
	1,000	879	816	809	826	708	782	640

HEIFERS, TWO YEARS OLD.

		Entrance Nos.		
	Points.	110	111	79
Head	30	20	25	28
Face	20	15	10	18
Eye	20	18	15	20
Horn	10	4	10	10
Neck	20	18	20	18
Chest	140	140	140	120
Brisket	50	50	40	45
Shoulder	40	35	40	30
Crops	80	80	80	65
Back, loin and hips	80	75	75	65
Rumps	50	50	35	35
Pelvis	20	....	....	....
Twist	30	25	25	20
Quarters	50	50	50	40
Carsase	40	40	38	30

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	Points.	Entrance Nos. 110	111	79
Flanks	30	28	28	15
Legs	20	18	20	10
Plates	30	30	30	25
Tail	20	20	18	15
Carriage	20	20	20	20
Quality	150	130	140	145
Coat	20	18	17	20
Udder	30	20	30	15
	1,000	906	907	809

	Heifers, One Year Old. Points.	Ent. Nos. 112	20	80	Calves. Ent. Nos. 114	113
Head	30	30	25	29	30	25
Face	20	20	15	10	20	18
Eye	20	20	15	15	20	15
Horn	10	8	10	10	10	10
Neck	20	20	20	18	18	18
Chest	140	140	140	120	140	140
Brisket	50	50	50	35	50	40
Shoulder	40	40	40	40	40	35
Crops	80	80	80	65	80	80
Back, loin and hips	80	75	65	60	80	70
Rumps	50	50	30	30	45	40
Pelvis	20	....	....	....	....	....
Twist	30	30	25	20	30	25
Quarters	50	50	40	35	50	45
Carcase	40	40	30	25	40	35
Flanks	30	30	25	20	30	25
Legs	20	18	20	15	20	18
Plates	30	25	30	30	30	30
Tail	20	18	18	20	15	20
Carriage	20	20	18	15	20	20
Quality	150	140	145	130	130	150
Coat	20	18	18	17	17	20
Udder	30	....	....	....	....	....
	1,000	922	869	750	915	882

CLASS I—CATTLE.

No. 1. Short Horns—Bulls.

1st premium bull, 3 years old and upwards, A. B. Conger, Waldberg, Rockland county, N. Y., "Fleur de Lis' son of 2d Duke of Thornedale;" bred by Samuel Thorne; got by 2d Duke of Thornedale; dam Fleur de Lis..... Dip. and $20

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2d premium bull, 3 years old and upwards, Frederick W. Stone, Moreton Lodge, Guelph, C. W., "Grand Duke of Moreton" 5732; bred by F. W. Stone; got by 3d Grand Duke (17993) (2292 A. H. B.); dam Maid of Guelph, by 12th Duke of Oxford (17742)..... $15

3d premium bull, 3 years old and upwards, A. B. Conger, Waldberg, "Grandson of Red Rose 2d and Duke of Gloster (11382);" bred by A. B. Conger; got by Daphné's son of Duke of Gloster (11382); dam Rose of Gloster.....Trans.

1st premium bull, 2 years old, E. Cornell, Ithaca, N. Y., "Fidget's Oxford;" bred by E. Cornell; got by 3d Lord Oxford (22200); dam Fidget 5th, by Delhi (15865)..... 20

1st premium bull, 1 year old, John D. Wing, Washington, Dutchess county, N. Y., "Emperor;" got by 6th Duke of Thornedale; dam Fleur de Lis, by imported Neptune (11847)..... 15

No. 2. SHORT HORNS—COWS.

1st premium cow, 3 years old and upwards, Ezra Cornell, Ithaca, "Lucilla;" bred by E. Cornell; got by Duke of Oxford 2780; dam Lucy Ann, by Cunningham (12671).....Dip. and $20

2d premium cow, 3 years old and upwards, A. B. Conger, Waldberg, "Sonerila;" bred by A. B. Conger; got by Earl Vane 464 (14483); dam Sonsie IX, by Augustus (11125)..... 15

3d premium cow, 3 years old and upwards, J. & S. Kinsey, Darien, "Amethyst;" bred by S. Thorne; got by Grand Turk (12969); dam Agnes, by Lord of Brawith (10465).....Trans.

1st premium heifer, 2 years old, E. Cornell, Ithaca, "Princess 16th;" bred by E. Cornell; got by St. Valentine, 4348½; dam Princess 12th, by Orion, 1964..... 20

2d premium heifer, 2 years old, E. Cornell, "Kirkleavington 12th;" bred by E. Cornell; got by 3d Lord Oxford (22200); dam Kirkleavington 11th, by Delhi (15865)..... 10

3d premium heifer, 2 years old, A. B. Conger, Waldberg, "Myrica;" got by Duchess 64th's son of 2d Grand Duke; dam Mazurka 8th.....Trans.

1st premium heifer, 1 year old, E. Cornell, Ithaca, "Lucia;" bred by E. Cornell; got by 3d Lord Oxford (22200); dam Lucinda, by Young Renick, 4524..... 15

2d premium heifer, 1 year old, Walcott & Campbell, New York Mills, "Hope;" bred by Walcott & Campbell; got by Weehawken, 5260; dam Lady Newham 2d..... 10

3d premium heifer, 1 year old, A. B. Conger, Waldberg, "Myrica 2d;" bred by A. B. Conger; got by Duchess of Airdrie's son of Duke of Airdrie; dam Mazurka 8th.....Trans.

1st premium heifer calf, E. Cornell, Ithaca, "Lucy Curd;" bred by E. Cornell; got by Kirkleavington, 5860; dam Lucy Ann, by Cunningham (12671)..... 5

2d premium heifer calf, E. Cornell, "Lucy Conklin;" bred by E. Cornell; got by Kirkleavington, 5860; dam Lucinda, by Young Renick, 4524..Trans.

L. G. MORRIS,
SAMUEL THORNE,
D. B. HAIGHT, *Judges.*

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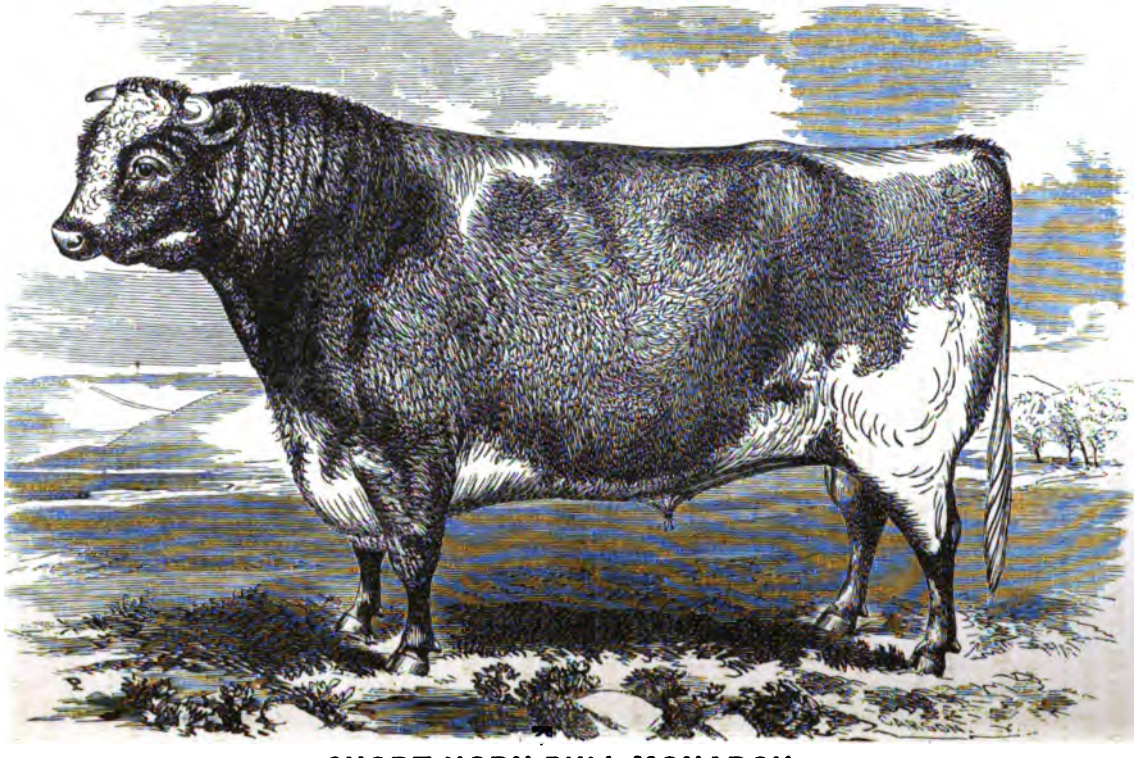

SHORT HORN BULL MONARCH.

Winner of the First Prize in his Class, at the New York State Fair at Rochester, 1868.
The property of C. K. Ward, Le Roy, Genesee Co., N. Y.

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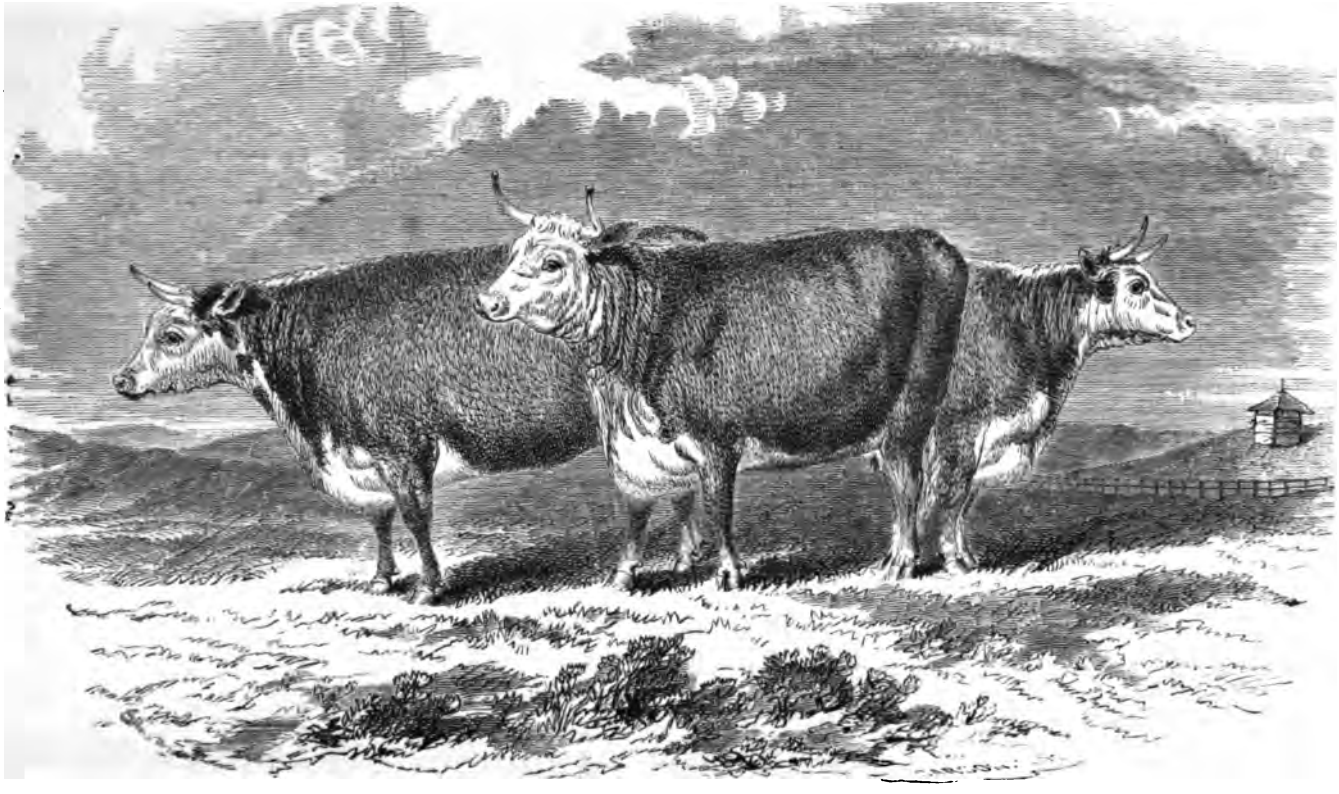

HEREFORD COWS—HEBE, BONNY LASS, AND GRACEFUL 2d.

The property of Frederick Wm. Stone, Moreton Lodge, Guelph, Ontario, Canada.

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Devon Herd.

Herd prize for Devons; the Society's Large Gold Medal; Walter Cole, Batavia, N. Y.

Bull "Queen Anne's Huron;" bred by E. G. Faile; got by Huron (652); dam Queen Anne (2302).

Cow "Helena 23d;" bred by C. S. Wainwright; got by Omer Pasha (513); dam Helena 11th (1397).

Cow "Lovely 18th;" bred by Ambrose Stevens; got by Young Exeter (765); dam Lovely 3d (857).

Cow "Helena 16th;" bred by C. S. Wainwright; got by Omer Pasha (513); dam Helena 3d (776).

Heifer "Harmony 2d;" bred by exhibitor; got by Huron (652); dam Harmony.

No. 3. Devons—Bulls.

1st premium bull, 3 years old and upwards, Walter Cole, Batavia, "Queen Anne's Huron;" bred by E. G. Faile; got by Huron (652); dam Queen Anne (2302) ..... Dip. and $20

2d premium bull, 3 years old, George Rudd, Guelph, C. W., "Prince William;" bred by Daniel Tye; got by Lord Elgin (156); dam Countess, by Woodstock (593) 15

1st premium bull, 1 year old, Walter Cole, "Helena's Huron;" bred by Walter Cole; got by Huron (652); dam Helena 16th, by Omer Pasha (513) 15

1st premium bull calf, Walter Cole, "Lovely's Huron 2d;" bred by Walter Cole; got by Queen Anne's Huron; dam Lovely 5th (1384) 5

No. 4. Devons—Cows.

1st premium cow, 3 years old and upwards, Walter Cole, Batavia, N. Y., "Helena 23d;" bred by C. S. Wainwright; got by Omer Pasha (513); dam Helena 11th (1397) ..... Dip. and $20

2d premium cow, 3 years old and upwards, Walter Cole, Batavia, N. Y., "Lovely 18th;" bred by Ambrose Stevens; got by Young Exeter (765); dam Lovely 3d (857) 15

3d premium cow, 3 years old and upwards, Walter Cole, "Helena 16th;" bred by C. S. Wainwright; got by Omer Pasha (513); dam Helena 3d (776) ..... Trans.

1st premium heifer, 2 years old, Geo. Rudd, Guelph, C. W., "Lady Ann;" bred by Daniel Tye; got by Lord Elgin (156); dam Fancy (244), by Don Juan (357) 20

1st premium heifer, 1 year old, Walter Cole, Batavia, "Harmony 2d;" bred by Walter Cole; got by Huron (652); dam Harmony 15

1st premium heifer calf, Walter Cole, Batavia, "Cole's Helena;" bred by Walter Cole; got by Queen Anne's Huron; dam Helena 7th (1393) ... 5

H. SCHOONMAKER,
E. P. FULLER, *Judges.*

Hereford Herd.

Herd prize for Herefords; the Society's Large Gold Medal; Frederick William Stone, Guelph, C. W.

Bull "Commodore" (2473); bred by exhibitor; got by (imp.) Patriot (2150); dam Vesta 2d (imp.), by Sheldon (1725).

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Cow "Bonny Lass;" bred by Lord Bateman; got by Carlisle (923); dam Little Beauty, by Andrew 2d (619).

Cow "Hebe;" bred by Lord Bateman; got by Carlisle (923); dam Young Spot, by Radnor.

Cow "Gentle 3d;" bred by exhibitor; got by Patriot (2150); dam Gentle (imp.), by Carlisle (923).

Heifer "Sweetheart;" bred by exhibitor; got by Guelph (2023); dam Sweetheart (imp.), by Albert Edward (859).

Heifer "Princess 2d;" bred by exhibitor; got by (imp.) Patriot (2150); dam Princess (imp.), by Carlisle (923).

No. 5. Herefords.

1st premium bull, 3 years old and upwards, Frederick W. Stone, Moreton Lodge, Guelph, C. W., "Commodore" (2473); bred by F. W. Stone; got by (imp.) Patriot (2150); dam Vesta 2d (imp.), by Shobdon (1725) ..... Dip. and $20

1st premium bull, 1 year old, F. W. Stone, "Prince of Canada;" bred by F. W. Stone; got by Guelph (2023); dam Peach (imp.), by Albert Edward (859) 15

1st premium bull calf, Erastus Corning, Jr., Albany, "Eclipse;" bred by E. Corning, Jr.; got by Major; dam Victoria 5th, by Washington ... 5

2d premium bull calf, E. Corning, Jr., "Major 2d;" bred by E. Corning, Jr.; got by Major; dam Rarity 1st, by Washington ..... Trans.

1st premium cow, 3 years old and upwards, E. Corning, Jr., "Marchioness;" bred by E. Corning, Jr.; got by Washington; dam Flora 2d, by Defiance ..... Dip. and $20

2d premium cow, 3 years old and upwards, F. W. Stone, Guelph, "Bonny Lass;" bred by Lord Bateman; got by Carlisle (923); dam Little Beauty, by Andrew 2d (619) 15

3d premium cow, 3 years old and upwards, E. Corning, Jr., "Victoria 5th;" bred by E. Corning, Jr.; got by S. Goddard; dam Victoria 4th, by Sir Tatton ..... Trans.

1st premium heifer, 2 years old, Erastus Corning, Jr., "Rarity 2d;" bred by E. Corning, Jr.; got by Major; dam Rarity, by Washington 20

2d premium heifer, 2 years old, F. W. Stone, Guelph, C. W., "Sweetheart 2d;" bred by F. W. Stone; got by Guelph (2023); dam Sweetheart (imp.), by Albert Edward (859) 10

3d premium heifer, 2 years old, F. W. Stone, Guelph, C. W., "Princess 2d;" bred by F. W. Stone; got by (imp.) Patriot (2150); dam Princess (imp.), by Carlisle (923) ..... Trans.

1st premium heifer calf, E. Corning, Jr., "Marchioness 3d;" bred by E. Corning, Jr.; got by Major; dam Marchioness 1st, by Washington ... 5

H. SCHOONMAKER,
J. A. SHEARMAN,
ISAAC AKIN, *Judges.*

Ayrshire Herd.

Herd prize for Ayrshires; the Society's Large Gold Medal; Walcott & Campbell, New York Mills, N. Y.

Bull "Tarbolton" (imp.).

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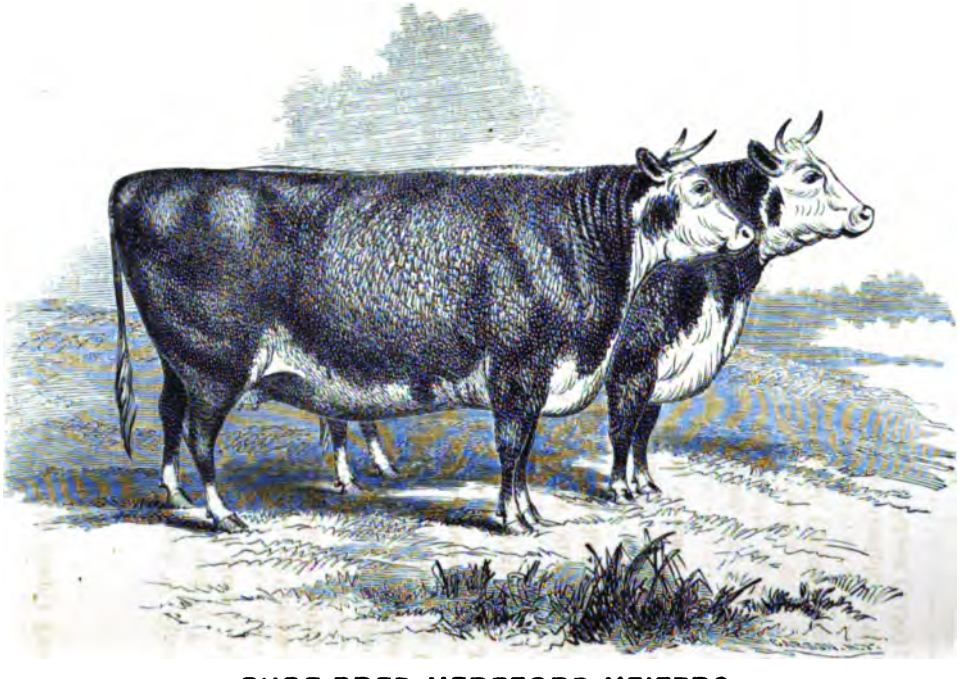

PURE BRED HEREFORD HEIFERS.

SWEETHEART 2d, 3 years old; and VESTA 4th, 18 months old. Bred by and the property of FREDERICK WM. STONE, Moreton Lodge, Guelph, Ontario, Canada.

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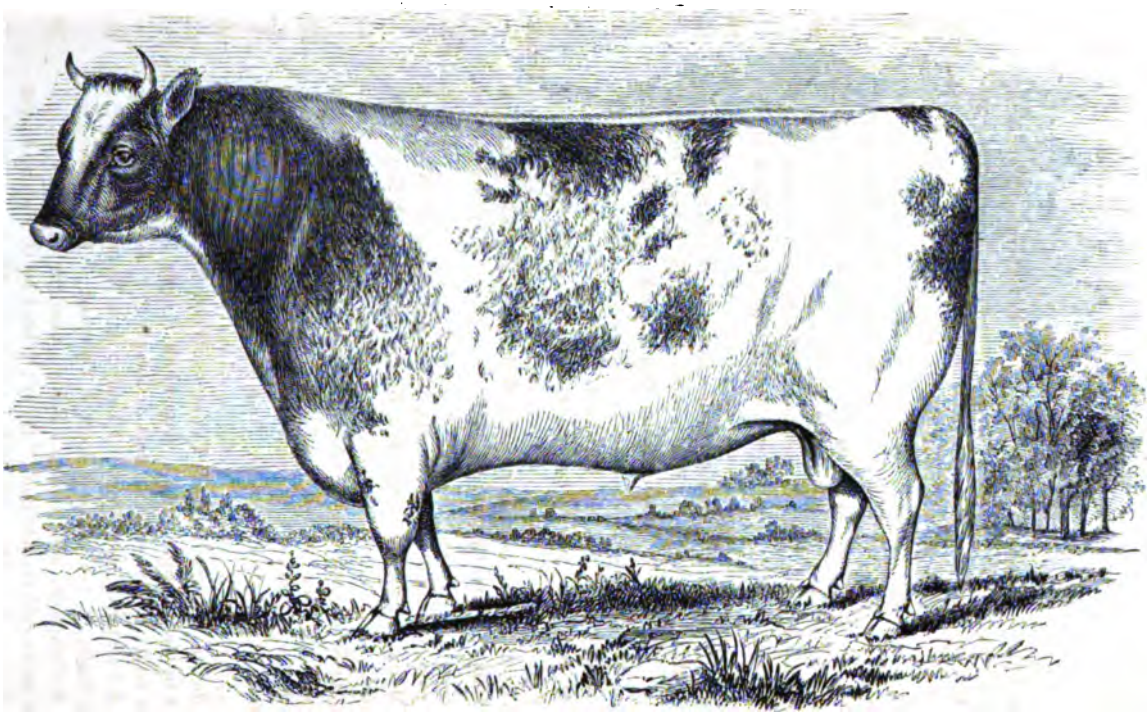

AYRSHIRE BULL—BALDY.

Imported by and the property of WALCOTT & CAMPBELL. New York Mills, N. Y.

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Cow "Daisy;" bred by Campbell & Brodie; got by Billy; dam Dairy Maid.
Cow "Maud;" bred by exhibitors; got by Rob Roy; dam May Flower.
Heifer "Bloom;" bred by exhibitors; got by (imp.) Baldy; dam White Lily.
Heifer "Helen Mar;" bred by exhibitors; got by (imp.) Baldy; dam (imp.) Helen Douglas.
Heifer "Jessie;" bred by exhibitors; got by (imp.) Baldy; dam Bonny Jean.

No. 6. AYRSHIRES

1st premium bull, 3 years old and upwards, J. F. Converse, Woodville, Jefferson county, N. Y., "Gen. Grant;" bred by J. F. Converse; got by Rob Roy (imp.); dam Flora Temple ..... Dip. and $20
2d premium bull, 3 years old and upwards, O. Howland, Auburn, "Governor 5th 15
1st premium bull, 2 years old, E. Harvey, Buffalo, "John McGregor;" bred by J. W. Freeman, Troy, N. Y.; got by John Anderson (33); dam Daisie 5th (47), by Zachary Taylor (78) 20
2d premium bull, 2 years old, O. Howland, Auburn, "Governor 7th;" bred by O. Howland; got by Governor 4th; dam Jenny Lind 3d, by Governor 3d 10
1st premium bull, 1 year old, James Brodie, Rural Hill, Jefferson county, 15
2d premium bull, 1 year old, J. F. Converse, Woodville, "Gold Dust;" bred by J. F. Converse: got by John Gilpin (imported); dam Flora Temple 10
3d premium bull, 1 year old, O. Howland, Auburn, "Governor 8th;" bred by O. Howland; got by Governor 5th; dam Jenny Lind 3d, by Governor 3d ..... Trans.
1st premium cow, 3 years old and upwards, Walcott & Campbell, New York Mills, "Daisy;" bred by Campbell & Brodie; got by Billy; dam Dairy Maid ..... Dip. and $20
2d premium cow, 3 years old and upwards, Walcott & Campbell, New York Mills, "Maud;" bred by Campbell & Brodie; got by Rob Roy; dam Mayflower 15
1st premium heifer, 2 years old, Walcott & Campbell, "Bloom;" bred by Walcott & Campbell; got by (imp.) Baldy; dam White Lily 20
2d premium heifer, 2 years old, Walcott & Campbell, "Helen Mar;" bred by Walcott & Campbell; got by (imp.) Baldy; dam (imp.) Helen Douglas 10
3d premium heifer, 2 years old, J. F. Converse, Woodville, "Flora Temple 2d;" got by John Gilpin (imp.); dam Flora Temple ..... Trans.
1st premium heifer, 1 year old, Walcott & Campbell; "Jessie;" bred by Walcott & Campbell; got by (imp.) Baldy; dam Bonny Jean 15
2d premium heifer, 1 year old, Walcott & Campbell, "Ella;" bred by Walcott & Campbell; got by (imp.) Baldy; dam (imp.) Libbie 10
1st premium heifer calf, O. Howland, "Daisy;" bred by O. Howland; got by Gen. Grant; dam Jenny Lind 2d, by Governor 4th 5
2d premium heifer calf, O. Howland, "Lily;" bred by O. Howland; got by Governor 5th; dam Jenny Lind 3d, by Governor 3d ..... Trans.

H. SCHOONMAKER,
J. A. SHEARMAN,
ISAAC AKIN, *Judges*

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ALDERNEY HERD.

Herd prize for Alderneys; the Society's Large Gold Medal; William B. Dinsmore, Staatsburgh, N. Y.

Bull "Jerry;" bred in Jersey, and imported by exhibitor, 1865.
Cow "Bettie;" imported by exhibitor, 1860.
Cow "Frankie;" imported by exhibitor, 1865.
Heifer "Gipsy 2d;" dropped on shipboard by heifer Gipsy; imported by exhibitor; Gipsy bred in Jersey.
Heifer "Poody;" bred by exhibitor; got by Pat, bred by G. G. Hammond, New London, Conn.; dam Alice, by (imp.) Jerry.
Heifer calf "Diana 3d;" bred by exhibitor; got by Jerry; dam Diana; granddam Sue 2d.

No. 7. ALDERNEYS

1st premium bull, 3 years old and upwards, E. Corning, Jr., Albany, "Romeo"* ..... Dip. and $20
2d premium bull, 3 years old and upwards, Wm. B. Dinsmore, Staatsburgh, Dutchess county, N. Y., "Jerry;" bred in Jersey, and imported by exhibitor in ship Villa Franca, 1865 15
1st premium bull, 1 year old, W. B. Dinsmore, "Albert;" bred by W. B. Dinsmore; sire (imp.) Jerry; dam Frankie (imp.) 15
1st premium cow, 3 years old and upwards, E. Corning, Jr., Albany, "Lady Eva"* ..... Dip. and $20
2d premium cow, 3 years old and upwards, W. B. Dinsmore, "Bettie;" imported by W. B. Dinsmore, 1860 15
3d premium cow, 3 years old and upwards, W. B. Dinsmore, "Frankie;" imported by W. B. Dinsmore, 1865 ..... Trans.
1st premium heifer, 2 years old, W. B. Dinsmore, "Gipsy 2d;" dropped on shipboard by heifer Gipsy imported by W. B. Dinsmore; Gipsy bred in Jersey 20
2d premium heifer, George C. Cook, Medina, Orleans county, "Jennie;" bred by J. W. Swan, Medina, N. Y.; got by Don Pedro; dam by Robert Darling (imp.); grand dam Strawberry (imp.) 10
3d premium heifer, 2 years old, E. Corning, Jr., "Juliet"* ..... Trans.
1st premium heifer, 1 year old, W. B. Dinsmore, "Poody;" bred by W. B. Dinsmore; got by Pat, bred by G. G. Hammond, New London, Ct.; dam Alice, by (imp.) bull Jerry 15
2d premium heifer, 1 year old, E. Corning, Jr., "Daisy 2d;"* 10
3d premium heifer, 1 year old, W. B. Dinsmore, "Diana 2d;" bred by W. B. Dinsmore; got by Pat, bred by G. G. Hammond; dam Diana ..... Trans.
1st premium heifer calf, W. B. Dinsmore, "Diana 3d;" bred by W. B. Dinsmore; got by Jerry; dam Diana 5
2d premium heifer calf, W. B. Dinsmore, "Lily 3d;" bred by W. B. Dinsmore; got by Jerry; dam Lily 2d, by (imp.) bull Jerry ..... Trans.

H. SCHOONMAKER,
J. A. SHEARMAN,
ISAAC AKIN, *Judges*

* Got by imported sires.

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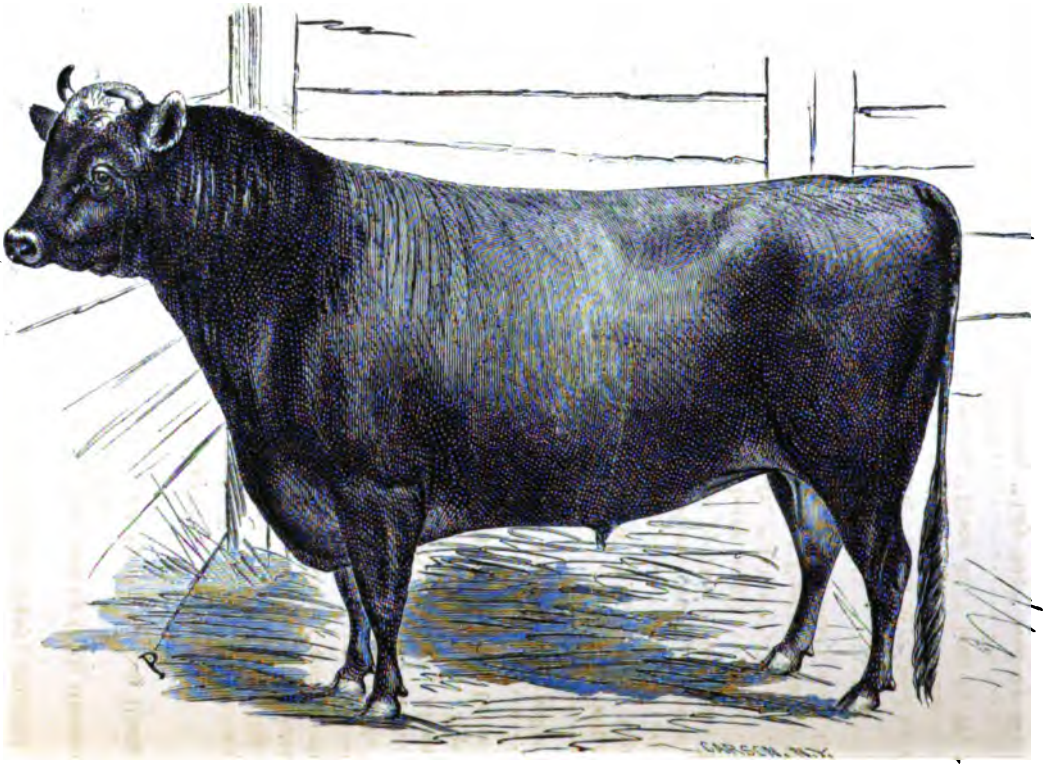

JERSEY BULL—JERRY.

Imported by and the property of W. B. Dinsmore, Staatsburgh, N. Y.

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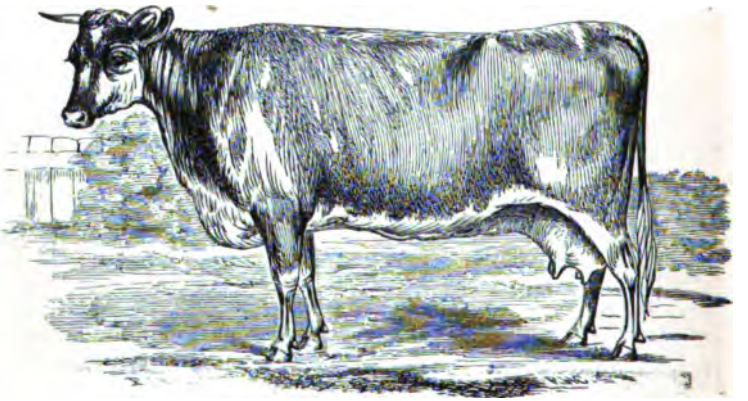

ALDERNEY COW—LADY EVA.

WINNER OF THE FIRST PRIZE for aged cows, at the Buffalo Fair of the New York State Agricultural Society, 1867. The property of E. CORNING, JR., Albany, N.Y.

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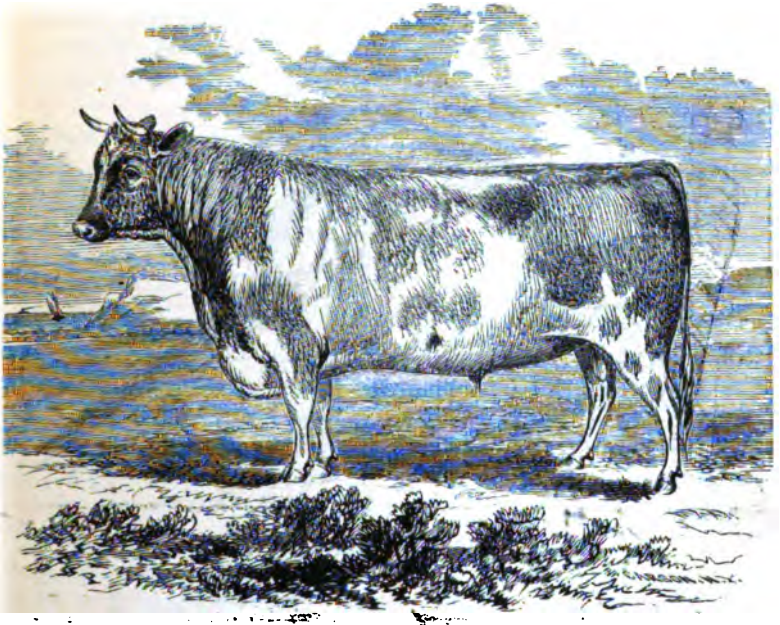

ALDERNEY BULL—ROMEO.

WINNER OF THE FIRST PRIZE for aged bulls, at the Buffalo Fair of the New York State Agricultural Society, 1867. The property of E. CORNING, JR., Albany, N.Y.

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No. 8. GRADE COWS AND HEIFERS.

Best grade short horn cow, O. Howland, Auburn $10
2d best, O. Howland, Auburn 5
Best grade Devon cow, James Tracy, Black Rock 10
2d best, G. W. Payne, North Buffalo..... 5
Best grade Ayreshire cow, O. Howland, Auburn..... 10
2d best, Geo. W. Payne, North Buffalo..... 5
Best grade Hereford cow, Geo. W. Payne..... 10
2d best, Geo. W. Payne..... 5

MILCH COWS.

Best milch cow, J. G. Meidenbaner, Buffalo ..... Dip. and $15
2d best, Charles F. Miller, Buffalo..... 10
3d best, J. G. Meidenbaner, Buffalo.....Trans.

Discretionary.

Galloway bull, Levi Gillette, Youngtown, N. Y..... ..... $10

Special.

1st premium grade heifer, R. L. Howard, Buffalo 10
2d premium, R. L. Howard, Buffalo..... 6

J. A. SHEARMAN,
D. RICE,
WM. R. BOOTH, *Judges.*

No. 9. OXEN, FOUR YEARS' OLD.

Best single yoke, Calvin Diver, West Brighton, Monroe county, N. Y.... $15
2d best, John C. Hirt, West Seneca..... 10

WM. R. BOOTH,
D. RICE,
BERRY LONG, *Judges.*

No. 10. STEERS, THREE YEARS OLD.

Best single yoke, H. Ames, Leicester, Livingston county, N. Y..... $10
2d best, W. B. Dinsmore, Staatsburgh, Dutchess county..... 8

WM. R. BOOTH,
D. RICE,
BERRY LONG, *Judges.*

No. 10. FAT CATTLE—STALL FED.

Best ox, 4 years and upwards, John W. Taylor, East Bloomfield..... $12
Best cow, 4 years and upwards, John W. Taylor..... 10
2d best, John W. Taylor..... 6
3d best, John W. Taylor.....Trans.
Best steer, 3 years old, John W. Taylor..... 8
2d best, John W. Taylor..... 3

No. 10. FAT CATTLE—ON HAY AND GRASS.

Best cow, 4 years and upwards, Thomas Hosebury, Lockport $10

CLASS II—HORSES.

No. 11. FOR ALL WORK—STALLIONS.

1st premium stallion, 4 years and upwards, William Dunkelberger, Lockport ..... Dip. and $20

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2d premium stallion, 4 years and upwards, L. S. Goodrich, Lockport..... $15
3d premium stallion, 4 years and upwards, Isaac Dysinger, Royalton, Niagara county.....Youatt
1st premium stallion for draught, 4 years and upwards, M. McDonald, Royalton, Niagara county..... Dip. and $20
2d premium stallion for draught, 4 years and upwards, R. L. Howard, Buffalo..... 15
1st premium stallion, 3 years old, Miss M. J. Cheesbro, Marilla, Erie county..... Dip. and $15
2d premium stallion, 3 years old, Charles Sims, Toronto, Canada..... 10
3d premium stallion, 3 years old, Henry Blocher, Clarence, Erie county... Dadd.
1st premium stallion, 2 years old, James Reid, Lockport..... 15
2d premium stallion, 2 years old, J. W. & J. M. Williams, Royalton..... 10
3d premium stallion, 2 years old, S. Welch, Sheenwater, Grand Island.... Dadd.
1st premium stallion, 1 year old, Gordon Merritt, Savannah, Wayne county..... 10
2d premium stallion, 1 year old, Chas. C. Clough, Buffalo..... 5
3d premium stallion, 1 year old, Solomon B. Dunkelberger, Lockport..... Dadd.

H. S. JARVIS,
W. P. OTTLEY,
H. L. ROBINSON, *Judges.*

No. 13. For Brood Mares and Foals.

For Draught.

2d premium brood mare (with foal at her foot), 4 years and upwards, for all work, G. W. Payne, North Buffalo..... $15
3d premium brood mare (with foal at her foot), 4 years and upwards, for all work, H. Friest, Attica.....Youatt
1st premium mare, 3 years old, Robert Bell, West Brighton, Monroe county..... Dip. and $15
2d premium mare, 3 years old, Richard Bullymore, Buffalo..... 10
3d premium mare, 3 years old, A. Bacon, Tonawanda ..... Dadd.
1st premium mare, 2 years old, Robert Bell, West Brighton..... 15
2d premium mare, 2 years old, George Hammill, Rome 10
1st premium mare, one year old, Robert Bell, West Brighton..... 10
2d premium mare, one year old, Richard Bullymore, Buffalo..... 5

H. S. JARVIS,
W. P. OTTLEY,
H. L. ROBINSON, *Judges.*

No. 12. Thoroughbred.

1st premium brood mare (with foal at her foot), T. J. Murphy, Buffalo..... Dip. and $20

H. S. JARVIS,
H. L. ROBINSON,
W. P. OTTLEY, *Judges*

No, 13. Matched Horses—Not Under Sixteen Hands.

1st premium pair of matched horses, for carriage, 16 hands and over, J. Ives Parsons, Auburn $15

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2d premium pair of matched horses, for carriage, 16 hands and over, C. M. Clark, Chicago, Ill..... $10
1st premium pair of carriage horses, 15 hands and over, Fayette Patrick, Chicago, Ill..... 15
2d premium pair of carriage horses, 15 hands and over, J. M. Davis, Richmond Hill, C. W..... 10
1st premium pair of driving or road horses, 14½ hands and over, D. R. Jerauld, Niagara Falls..... 15
2d premium pair of driving or road horses, 14½ hands and over, E. B. Fellows, Le Roy, Genesee county..... 10
2d premium pair of farm or draught horses, Dodge & Stevenson, Manufacturing Company, Auburn..... 10
1st premium single gelding, 4 years and upwards, in harness, Wm. Wells, Buffalo..... 10
2d premium single mare, 4 years and upwards, in harness, James Reid, Lockport..... 8
1st premium single trotting horse, in harness, A. B. Conger, Haverstraw, Rockland county..... 10
2d premium single trotting mare, in harness, Robert Ovens, Buffalo..... 8

Special.

Pair of 3 years old geldings, Isaac M. Shotwell, Elba, Genesee county.... 5

C. J. ADAMS,
A. B. LARKIN,
M. C. MORDOFF, *Judges.*

No. 14. JACKS AND MULES.

1st premium jack, Hugh Owens, Newport, Herkimer county..... $15
1st premium pair of mules, Miller & Plympton, Buffalo..... 10
1st premium pair of mule colts, M. V. Kirby, Kankakee City, Ill..... 10

WM. M. WHITE,
I. H. COCKS,
C. J. BLOOD, *Judges.*

SHETLAND PONIES.

Fourteen in number were entered by Mrs. J. C. Lord, of Buffalo. They were exercised upon the fair grounds, and attracted very great attention. The thanks of the board were presented to Mrs. Lord, and a diploma of the Society awarded her.

CLASS III—SHEEP.

No. 15. (B) LONG-WOOLED—LEICESTER.

1st premium ram, 2 years and upwards, John Gill, Grahams, C. W..... $10
2d premium ram, 2 years old and upwards, Donald Robertson, Queenstown, C. W..... 8
3d premium ram, 2 years old and upwards, John Snell, Edmonton, C. W..... Prac. Shep.
1st premium ram, under 2 years, John Snell, Edmonton, C. W..... 10
2d premium ram, under 2 years, Donald Robertson, Queenstown, C. W... 8
3d premium ram, under 2 years, John Gill, Grahams, C. W.....Prac. Shep.
1st premium pen five ewes, under 2 years, Wallcott & Campbell, New York Mills..... 10

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2d premium pen five ewes, under 2 years, Donald Robertson, Queenstown, C. W..... $8
1st premium pen 3 ram lambs, Wallcott & Campbell, New York Mills.... 5
2d premium pen 3 ram lambs, John Gill, Grahams, C. W..... Prac. Shep.
1st premium pen 3 ewe lambs, Donald Robertson, Queenstown, C. W.... 5

G. B. & C. R. Durkee, Alden, Erie county, entered twelve goats. Your committee confess their inability to intelligently recommend any premiums on goats.

SAMUEL W. SMITH,
WILLIAM DUNLAP,
SAMUEL H. BARONS, *Judges.*

No. 15. (C) LONG-WOOLED SHEEP—NOT LEICESTERS.

1st premium ram, 2 years and upwards, Fred. Wm. Stone, Moreton Lodge, Guelph, Ontario, Dominion of Canada..... $10
2d premium ram, 2 years and upwards, Wallcott & Campbell, New York Mills..... 8
3d premium ram, Isaac Aikens, Beekman, Dutchess county..... Prac. Shep.
1st premium ram, under 2 years, John Snell, Edmonton, C. W..... 10
2d premium ram, under 2 years, Fred. Wm. Stone, Guelph, Ontario, Canada..... 8
3d premium ram, under 2 years, John Snell, Edmonton, C. W. .... Prac. Shep.
1st premium pen 5 ewes, 2 years and upwards, John D. Wing, Washington, Dutchess county..... 10
2d premium pen 5 ewes, 2 years and upwards, Walcott & Campbell, New York Mills..... 8
1st premium pen 5 ewes, under 2 years, Fred. W. Stone, C. W..... 10
2d premium pen 5 ewes, under 2 years, Isaac Aikins, Beekman, Dutchess county..... 8
3d premium pen five ewes, under 2 years, John D. Wing, Washington, Dutchess county..... Prac. Shep.
1st premium pen 3 ram lambs, Fred. W. Stone, Guelph, Ontario, Canada, 5
2d premium pen 3 ram lambs, Wallcott & Campbell, New York Mills.. Prac. Shep.
1st premium pen 2 ewe lambs, John Gill, Grahams, C. W..... 3

Your committee would respectfully call the attention of the board of managers to the fact that Lincolns have been compelled to compete with Cotswolds, and would suggest that hereafter premiums be offered for each breed.

SAMUEL W. SMITH,
WILLIAM DUNLAP,
SAMUEL H. BARONS, *Judges.*

No. 16. (A) SOUTH DOWNS.

1st premium ram, 2 years and upwards, L. L. Lorrillard, West Farms.... $10
2d premium ram, 2 years and upwards, Fred. Wm. Stone, Guelph, Canada 8
3d premium ram, 2 years and upwards, L. L. Lorrillard, West Farms. Prac. Shep.
1st premium ram, under 2 years, Geo. H. Brown, Washington Hollow.... 10
2d premium ram, under 2 years, Fred. W. Stone, Guelph, Canada..... 8
3d premium ram, under 2 years, Fred. W. Stone, Guelph, Canada.. Prac. Shep.
1st premium pen 5 ewes, 2 years and upwards, Fred. W. Stone, Guelph, Canada..... 10
1st premium pen 5 ewes, under 2 years, Fred. W. Stone, Guelph, Canada.. 10

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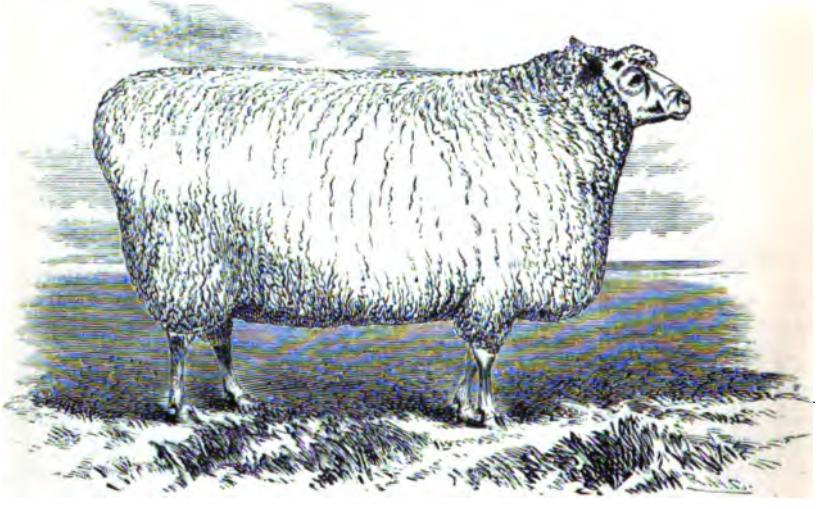

PURE BRED FOUR SHEAR COLTSWOLD RAM.

Bred by and the property of Frederick Wm. Stone, Moreton Lodge, Guelph, Ontario, Canada. Winner of First Prize, at the Provincial Show, at Hamilton, 1868, then weighing over $400 lbs.

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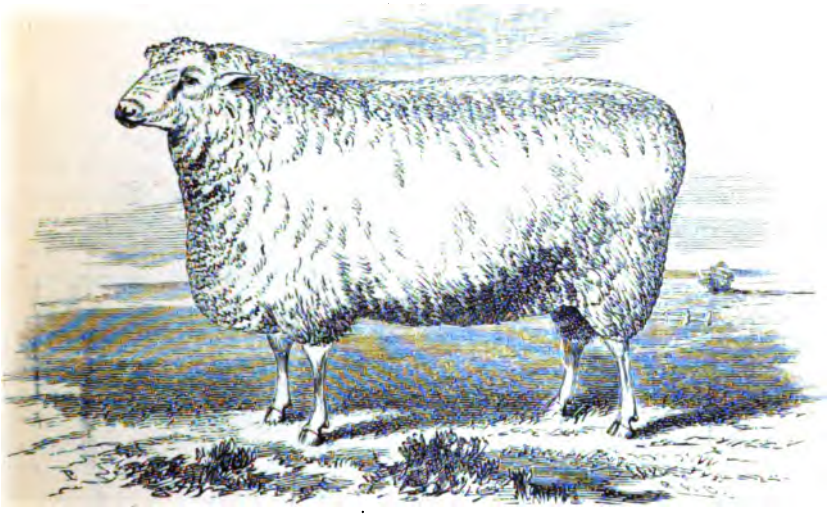

PURE BRED SHEARLING COTSWOLD RAM.

Bred by Fred'k Wm. Stone, Moreton Lodge, Guelph, Ontario, Canada.

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2d premium pen 5 ewes, under 2 years, George H. Brown, Washington Hollow $8
3d premium pen 5 ewes, under 2 years, L. L. Lorrillard, West Farms. Prac. Shep.
1st premium pen 3 ram lambs, Fred Wm. Stone, Guelph, Canada..... 5
2d premium pen 3 ram lambs, A. McArthur, Buffalo..... .... Prac. Shep.

JURIAN WINNE,
R. H. BROWN, *Judges.*

No. 16. (B) MIDDLE-WOOLED—NOT SOUTH DOWNS.

1st premium Hampshire Down ram, 2 years and upwards, John Snell, Edmonton, C. W. $10

No. 16. (C) CROSS BREED, BRED FOR MUTTON—EWES AND LAMBS.

2d premium pen 3 ewe lambs, A. McArthur, Buffalo..... Prac. Shep

JURIAN WINNE,
R. H. BROWN, *Judges.*

No. 17. (A) MERINOES.

(*Bred with especial reference to Fineness of Wool.*)

1st premium ram, 2 years and upwards, Wm. Chamberlain, Red Hook... $10
2d premium ram, 2 years and upwards, Carl Heyne, Red Hook..... 8
1st premium ram, under 2 years, Wm. Chamberlain, Red Hook..... 10
2d premium ram, under 2 years, Carl Heyne, Red Hook 8
1st premium pen 3 ewes, 2 years and upwards, Wm. Chamberlain, Red Hook..... 10
2d premium pen 3 ewes, 2 years and upwards, Wm. Chamberlain, Red Hook..... 8
1st premium pen 3 ewes, under 2 years, Carl Heyne, Red Hook..... 10
2d premium pen 3 ewes, under 2 years, Wm. Chamberlain, Red Hook 8
1st premium pen ewe lambs, Wm. Chamberlain..... 5
Your committee recommend to G. C. Cook, Medina, Orleans county, a discretionary award on his yearling ram..... Dip.

O. F. MARSHALL,
WM. M. HOLMES, *Judges.*

No. 17. (B) MERINOES.

(*Bred with especial view to Weight of Fleece.*

1st premium ram, 2 years and upwards, Bush & Peck, Shoreham, Vt..... $10
2d premium ram, 2 years and upwards, Townsend & Talmadge, Pavilion, Genesee county..... 8
1st premium ram, under 2 years, Townsend & Talmadge, Pavilion 10
2d premium ram, under 2 years, Wm. Chamberlain, Red Hook..... 8
1st premium pen 3 ewes, 2 years and upwards, E. Townsend, Pavilion, Genesee county..... 10
2d premium pen 3 ewes, 2 years and upwards, Wm. Chamberlain, Red Hook..... 8
1st premium pen 3 ewes, under 2 years, Townsend & Talmadge, Pavilion.. 10
1st premium ram lambs, H. M. Boardman, Rushville. 5
1st premium pen 3 ewe lambs, S. B. Lusk, Batavia..... 5
2d premium pen 3 ewe lambs, H. M. Boardman, Rushville..... Prac. Shep

E. N. BISSEL,
JOHN CRIDLER, *Judges.*

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No. 17. (C) MERINOES.

(*Bred with especial view to Form of Body, or Constitution, and Light Keeping.*)

1st premium ram, 2 years and upwards, H. C. Burwell, Bridgeport, Vt... $10
2d premium ram, 2 years and upwards, Wm. Halnon, Middlebury, Vt.... 8
1st premium ram, under 2 years, Townsend, Talmadge & Pierce Bros., Pavilion 10
2d premium ram, under 2 years, J. A. Wright, Middlebury, Vt..... 8
1st premium pen 3 ewes, 2 years and upwards, Townsend & Talmadge, Pavilion 10
2d premium pen 3 ewes, 2 years and upwards, Townsend & Talmadge, Pavilion..... 8
1st premium pen 3 ewes, under 2 years, Townsend & Talmadge, Pavilion.. 10
2d premium pen 3 ewes, under 2 years, Townsend & Talmadge, Pavilion.. 8
1st premium pen 3 ewe lambs, S. B. Lusk, Batavia..... 5
2d premium pen 3 ewe lambs, H M. Boardman, Rushville.....Prac. Shep.

H. D. McCALL,
J. W. HYDE,
H. H. CHAPIN, *Judges.*

No. 17. (D) MERINOES.

(*Bred with a Combined view to Fineness of Wool, Weight of Fleece and Body*).

1st premium ram, 2 years and upwards, J. E. Parker, Whiting, Vt., "Young Gold Drop"..... $10
2d premium ram, 2 years and upwards, Wm. Chamberlain, Red Hook, N. Y. 8
1st premium ram, under 2 years, Wm. Chamberlain, Red Hook, N. Y..... 10
2d premium ram, under 2 years, A. Thompson, Clarence, Erie county..... 8
1st premium pen 3 ewes, 2 years and upwards, H. M. Boardman, Rushville, Ontario county..... 10
2d premium pen 3 ewes, 2 years and upwards, E. Townsend, Pavilion, Genesee county..... 8
1st premium pen 3 ewes, under 2 years, Wm. Chamberlain, Red Hook.... 10
2d premium pen 3 ewes, under 2 years, Van Vliet, Wright & Parmalee, Weybridge, Vt..... 8
1st premium pen ram lambs, John A. Thompsom, Clarence..... 5
2d premium pen ram lambs, Wm. Chamberlain, Red Hook.....Prac. Shep.
2d premium pen 3 ewe lambs, Wm. Chamberlain, Red Hook.....Prac. Shep.

Your committee would recommend that Silesian Merinoes hereafter be put under another committee, as at present it is a source of great embarrassment in making the awards.

PARSOLL H. PETERSON,
ANTHONY HOFFMAN,
HENRY KRUM, *Judges.*

No. 18. CROSS BREED, BRED FOR WOOL—EWES AND LAMBS.

1st premium pen 5 ewes, 2 years and upwards, Wm. Chamberlain, Red Hook..... $10
1st premium pen 5 ewes, under 2 years, Wm. Chamberlain, Red Hook.... 10
1st premium pen 3 ewe lambs, Wm. Chamberlain, Red Hook 8
1st premium Shepherd's dog, C. E. West, Buffalo, N. Y..... 5

ANTHONY HOFFMAN,
HENRY KRUM, *Judges.*

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No. 18. (A) Fine Wool Sheep and their Fleeces.

1st premium pen 5 ewes, E. Townsend, Pavilion, Genesee county..... $20

ANTHONY HOFFMAN,
HENRY KRUM, *Judges.*

No. 19. Swine—Large Breed.

1st premium boar, 2 years old and upwards, A. C. Clark, Henderson, Jefferson county..... $10
2d premium boar, 2 years old and upwards, S. P. Huffstater, Watertown.. 5
1st premium boar, 1 year old, S. P. Huffstater, Watertown..... 10
2d premium boar, 1 year old, A. C. Clark, Henderson, Jefferson county... 5
1st premium boar, 6 months and under one year, A. C. Clark, Henderson, Jefferson county..... 8
2d premium boar, 6 months and under 1 year, James Brodie, Ellisburgh, Rural Hill post-office..... 4
1st premium breeding sow, 2 years old and upwards, A. C. Clark, Henderson 10
2d premium breeding sow, 2 years old and upwards, A. C. Clark, Henderson 5
1st premium breeding sow, 1 year old, T. T. Cavanaugh, Watertown, Jefferson county..... 10
2d premium breeding sow, 1 year old, James Brodie, Ellisburgh..... 5
1st premium sow, 6 months and under 1 year, James Brodie, Ellisburgh .. 8
2d premium sow, 6 months and under 1 year, T. T. Cavanaugh, Watertown 4
1st premium lot of pigs, not less than 5, under 10 months, James Brodie, Ellisburgh..... 8
2d premium lot of pigs, not less than 5, under 10 months, A. C. Clark, Henderson 4

Small Breed.

1st premium boar, 1 year old, C. E. West, Buffalo..... $10
1st premium boar, 6 months and under 1 year, F. McLean, Henderson, Jefferson county 8
2d premium boar, 6 months and under 1 year, F. McLean, Henderson, Jefferson county..... 4
1st premium breeding sow, 1 year old, C. E. West, Buffalo..... 10
2d premium breeding sow, 1 year old, Robert Bell, West Brighton, Monroe county 5
1st premium sow, 6 months and under 1 year, W. H. Davis, Spring Brook, Erie county..... 8
2d premium sow, 6 months and under 1 year, W. H. Davis, Spring Brook, Erie county..... 4
1st premium lot of pigs, not less than 5, under 10 months, John W. Robson, London, C. W..... 8
2d premium lot of pigs, not less than 5, under 10 months, D. C. Bennett, Cheektowaga, Erie county..... 4

Your committee having 77 entries of Swine, find it very difficult to discriminate between so many of such superior quality.

Mr. T. T. Cavanaugh, Watertown, exhibited a very fine large sow, two years old, but the judges consider her too fat for breeding.

L. D. MITCHELL,
CHAS. C. HOLTON
E. B. KELLOGG, *Judges.*

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No. 20. Poultry.

1st premium lot of white Dorkings, G. H. Warner, New York Mills, Oneida county $3
2d premium lot of white Dorkings, E. A. Wendell, Albany 2
1st premium gray or speckled Dorkings, B. H. Nichols, Lockport 3
2d premium gray or speckled Dorkings, L. L. Lorillard, West Farms, Westchester county 2
1st premium lot of black Spanish, B. H. Nichols, Lockport 3
2d premium lot of black Spanish, E. A. Wendell, Albany 2
1st premium lot black Polands, E. A. Wendell, Albany 3
1st premium lot silver Polands, E. A. Wendell, Albany 3
2d premium lot silver Polands, E. A. Wendell, Albany 2
1st premium lot Bolton Grays, B. H. Nichols, Lockport 3
2d premium lot Bolton Grays, E. A. Wendell, Albany 2
1st premium lot game, B. H. Nichols 3
2d premium lot game, E. A. Wendell 2
1st premium lot Leghorn fowls, E. A. Wendell 3
2d premium lot Leghorn fowls, B. H. Nichols 2
1st premium lot gold-lace bantams, L. F. Allen, Black Rock 3
2d premium lot gold-lace bantams, L. F. Allen, Black Rock 2
1st premium silver-lace bantams, B. H. Nichols 3
1st premium lot Bramahs, G. H. Warner 3
1st premium lot young Bramahs, B. H. Nichols, Lockport ..... Trans.
1st premium lot black bantams, E. A. Wendell, Albany 3
1st premium lot French fowls, B. H. Nichols 3
2d premium lot French fowls, E. A. Wendell 2

Turkeys.

1st premium pair turkeys, B. H. Nichols, Lockport 3
2d premium pair turkeys, E. A. Wendell, Albany 2

Ducks.

1st premium pair Muscovy, E. A. Wendell, Albany 3
1st premium pair Aylesbury, B. H. Nichols, Lockport 3
2d premium pair Aylesbury, E. A. Wendell 2
1st premium black Cayugas, Robert Bell, West Brighton, N. Y. 3
1st premium pair topknots, Robert Bell, West Brighton, N. Y. 3
2d premium pair topknots, E. A. Wendell 2
1st premium pair Rouen, G. H. Warner, New York Mills 3
2d premium pair Rouen, G. H. Warner, New York Mills 2

Geese.

1st premium pair Bremen, Peter Wannemacher, Buffalo 3
1st premium brown China, L. F. Allen, Black Rock 3
2d premium brown China, L. F. Allen, Black Rock 2
1st premium pair white China, L. F. Allen, Black Rock, Erie county, N. Y. 3
2d premium pair white China, L. F. Allen, Black Rock, Erie county, N. Y. 2
1st premium pair African, E. A. Wendell 3
2d premium pair African, William Johnson, Grand Island 2

Guinea Fowls.

1st premium lot, E. A. Wendell 3
2d premium lot, E. A. Wendell 2

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PIGEONS.

1st premium and greatest variety, Charles F. Menach, Buffalo..... $3
2d premium and greatest variety, F. D. Phillips, Albany..... 2

RABBITS.

1st premium pair long-eared, Thomas Gould, Aurora..... 3
2d premium pair long-eared, Thomas Gould, Aurora..... 2
1st premium pair common, F. D. Phillips, Albany..... 3
2d premium pair common, F. D. Phillips, Albany..... 2

Discretionary.

Coach dogs, E. A. Wendell, Albany.....Trans.
Fine display of cats, Master J. S. Holmes, Buffalo.....Trans.

The judges beg to report that the exhibition of poultry was not what it might have been had the premiums offered been double the amount given. We think it would tend to bring a greater number of exhibitors from other parts. We also recommend that the poultry in future be more carefully classified, so as to enable the judges to award the prizes with greater facility. For instance, the class of game birds, prizes should be awarded to the different breeds, and not exhibited all in one class. We consider, from the interest taken by spectators, that the poultry department is one of the most attractive parts of the exhibition. Hoping that the Executive Committee will take this matter into consideration for the welfare of the Society, we are,

Your respectfully,

WM. SIMPSON, JR.,
JOHN PETERS,
E. TEALE, *Judges.*

CLASS IV—FARM IMPLEMENTS AND MACHINERY.

No. 21. TILE DRAINING.

Best tile draining, John Lyth & Son, Buffalo..... $10

JONATHAN TALCOTT,
RICHARD PEEK, *Judges.*

No. 22. ARTICLES TO WHICH PREMIUMS MAY BE AWARDED WITHOUT TRIAL.

Best farm wagon, James Kay, Galt, C. W..... $5
Best dozen wire brooms, F. P, Wood & Co., Buffalo..... 3
Best dozen twine tied brooms, F. P. Wood & Co., Buffalo..... 3

Discretionary.

Best spring freight wagon, A. A. Austin, Buffalo..... Dip.
Best truck wagon, Dodge & Stevenson, Manufacturing Company, Auburn. Dip.

FRANK OLDS,
J. C. DEUEL, *Judges.*

No. 23. IMPLEMENTS FOR WORKING THE GROUND AND PUTTING IN CROPS.

Best roller for general use, A. S. Skiff, Trenton Falls, N. Y..... Dip.
2d best, J. N. Smith, Camillus, Onondaga county, N. Y.....Trans.
Best clod crusher, Buffalo Agricultural Works, Buffalo..... Dip.
Best grain drill, Seymour, Morgan & Allen, Brockport..... Dip.
2d best, Bickford & Hoffman, Macedon, Wayne county..... Dip.
Best wire fence, A. C. Betts, Troy, N. Y..... Dip.

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Farm gate, Hermance & Cooney, Schuylerville, Saratoga county, N. Y.... Dip.
Combined seed and fertilizer sower, Osborn, Foster & Co., Palmyra, N. Y. Dip.
Seed and corn planter, L. Larcher, Utica..... Dip
Farm gate and fence, Healy & Co., South Dansville, Steuben Co., N. Y... Dip.
Farm sled, S. E. Oviatt, West Richfield, Ohio..... Dip.
Hoisting and binding machine, F. W. Effingham, Lafayette, Onondaga Co., N. Y..... Dip

ANSON A. SWEET,
JONAS YOUNG, *Judges*

REPORT OF THE COMMITTEE ON THE COTTON SEED PLANTER.

The undersigned, appointed a special committee to examine a cotton seed planter, presented by N. B. Sherwood of Millville, Orleans county, N. Y., have given a careful examination to the machine, and offer the following report:

The Price of it is $100. *Its Weight is* 175 *pounds.*

The Planter runs on two cast-iron wheels in front, thirty inches in diameter, and two inches broad, which run in the dead furrow, and a grooved wheel eighteen inches in diameter and seven inches wide, having a semi-circular groove on the periphery which runs on the top of the furrow, and covers and presses down the seed. The seed is deposited in a box six inches wide, and of a length and depth proportioned to the desired capacity; the front end of the box is furnished with an adjustable partition, which stands at an angle of forty-five degrees when the box is full, and which rises in proportion to the amount of seed which has been dropped; this motion is produced by a bell crank having a weight on one end, while the other end presses on the adjustable partition and raises it as the box empties, so that the seed is kept in constant contact with the hooks.

A drum is placed in the rear of the box three and three-quarter inches in diameter, having a series of teeth placed at proper intervals which are three-eighths inches broad, and having a slot cut in the centre of each wide enough to receive the single link of the chain, while the projecting parts move forward the shoulders of the double link. Three chains run on this drum, made like a watch chain, of double and single links placed alternately, and which hang down nearly to the floor of the box; there is no lower drum, than our gravity being sufficient to insure their running. On these chains at suitable distances, and arranged spirally on them, are arms placed transversely, from which hooks in the form of a cat's claw are inserted vertically. These chains move in the direction of the rear from the front, hence the operation is to raise the seed opposite to the direction of gravity, and they raise it in very unequal quantities, owing to the cohesion of the seeds. A brush revolving before the chains at six times the speed of the drum on which they run, removes the excess and throws the surplus back into the box. The hooks are divested of the seeds which adhere to them, by another brush, which revolves behind them with the same speed as the brush in front; the seeds then drop into a tunnel which terminates in funnel, which is armed at the bottom with a coulter. There is a pane of glass in the rear of the box, through which the man who attends the machine can observe the dropping of the seed, and if anything occurs to interrupt the regularity of the planting, he can interpose at once, and make the necessary correction.

It can be easily thrown out of gear when it is not planting, so that it can be moved about at pleasure.

The motion is communicated to the drums and brushes through a chain (made

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on the principle of a watch chain) from the axle of the front wheels, and by a series of cog-wheels, by which the different speeds required are produced. The coulter can be elevated or depressed vertically by a lever at the side, which is fastened to an iron circle by a pin which keeps it at any desired point of elevation.

The amount of seed sown on a given area is regulated by means of reversible cones, on which the chain runs. By this arrangement any quantity, from one to six bushels of seed can be sown on an acre with very great accuracy. We tested it on the ground, and found that the great difficulties which have heretofore prevented the success of this class of planters has been fully overcome, and that the delivery of the seed was as regular as could be desired.

We therefore confidently recommend it as a successful and reliable cotton seed planter, and recommend that the diploma of the society be awarded to it.

JOHN STANTON GOULD,
HENRY WATERMAN,
SAML. CAMPBELL, *Com.*

No. 24. MACHINES AND IMPLEMENTS FOR GATHERING, THRASHING AND CLEANING CROPS.

Best portable grist mill, J. Pollock, Syracuse..... Dip.
2d best, Thomas Angell, Buffalo..... Trans.
2d best clover mill and cleaner, Glen & Hall, Rochester..... Trans.
Timothy gatherer, L. A. & G. J. Jones, Barrington, Yates county.....Fav. Men.
Best corn sheller (hand power), J. Brinkerhoof, Auburn..... Dip.
2d best, George Parsell, Akron, Ohio..... Dip.
Best vegetable cutter, John R. Robertson, Syracuse..... Dip.
2d best, A. H. Wellington, Rutland, Vt..... Trans.

Discretionary.

* Best feed cutters, Blymer, Day & Co., Mansfield, Ohio..... Dip.
* Grain separator, E. C. Patterson, Rochester, N. Y..... Dip.
* Fanning mill, J. J Bradner, Pine Creek, Schuyler county... Trans. and Cert.
* Burdick's National fodder cutter, J. D. Burdick & Co., New Haven, Ct.. Dip.

GEORGE COLLINS,
BENNETT GRAY, *Judges.*

No. 25. HAND TOOLS, &c., DAIRY IMPLEMENTS.

Best six hay forks, Montgomery Fork Company, New York..... $3
Best churn, Saffell & Baldwin, Tiffin; Ohio..... 3
Best dash churn, Seneca Falls Churn Manufacturing Company, Seneca Falls, N. Y..... Dip
Best cheese factory gang-press screws, O. O'Neill & Co., Utica..... Dip
Best cheese factory press hoops (wood), William Ralph & Co., Utica..... Dip.
Best cheese factory press hoops (metal, iron), O. O'Neil & Co..... Dip.
Best cheese factory carrying cans, O. O'Neill & Co..... Dip.
Best cheese factory curd cutting knife, O. O'Neill & Co..... Dip.
Best cheese factory curd agitator, O. O'Neill & Co..... Dip.
Best water heating apparatus, H. & E. F. Cooper, Watertown..... Dip.

* As this class of implements were tested at the Auburn trial in 1866, it was not the purpose of the Society to make awards on such implements this year. These awards will be submitted to the Executive Board for their decision.

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Discretionary

Hand planing mill, Reid & Gorton, North Brookfield, N. Y. ..... Dip.
Combined churn and butter worker, W. E. Skinner, Milford, Mich..... Dip
* Horse hay-fork, E. M. Krum, Nassau, Rensselaer county..... Dip.
* Hay and grain rake, P. C. Taylor, Dayton, Ohio..... Dip.
Curd draining sink, Wm. Ralph & Co., Utica, N. Y..... ..... Dip.

FRANK OLDS,
EDWARD H. RICHMOND, *Judges.*

No. 26. STEAM ENGINES AND OTHER MACHINES.

For the most valuable machine or implement for the farmer, "Ditching Machine," Edward Heath, Fowlerville, Livingston co.. Dip. & L. Bronze Med.
For the strongest and most durable hay scale, Sampon Scale Company, New York ..... Dip.
For the most accurate and sensitive hay scales, Buffalo Scale Company, Buffalo N. Y..... Dip.
(The platform scales used by the Society were furnished by the Howe Scale Company. The company cheerfully complied with the request of the Society to furnish them for their use, which was done free of charge. L. Danforth, agent, Buffalo.)
Best stump extractor, L. C. English, Corning..... L. B. Med.
Best drain tile and pipe machine, John Lyth & Son, Buffalo..... L. B. Med.
Best tile or other invention for securing run of water in drains (Hydraulic Cement tile), Copeland, Rathbun & Co., Buffalo..... Dip.
Best pump for farm use, Hiram Lawton, Rochester..... Dip.
Best water elevator, Jones & Pasko, Attica, N. Y..... Dip.
Best portable cider and wine mill, Samuel Males, Cincinnati, Ohio.. .... Dip.
Best clothes wringer, "Universal," R. C. Browning, New York.. Dip. and Cert.
2d best clothes wringer, "Champion," Jewett, Church & Co., Buffalo. S. S. Med.

Discretionary.

Planing machines, tenoning machine, sash sticking and moulding machine, foot morticing machine, blind-slat tenoner, wireing machine, foot mitre, grinding machine, brad punch, cramp screw, planer knives and saw arber, Frank & Co., Buffalo..... Dip.
Smut machine, Exelby & Marshall, Buffalo..... Dip.
Brick machine, Samuel Shreffler, Joliet, Ill..... Dip.
Tug propeller engine, pat. steam hammer, donkey steam pump, propeller wheel, David Bell, Buffalo..... Dip.
Hand loom, E. P. Cooper, Holland, Erie county..... Dip.
Howe's hay, platform, and counter scales, and Ingersoll's hay press, L. Danforth, Buffalo..... Dip.
Washing machine, Sehnders & Wackerman, Buffalo..... ..... Dip.
Domestic spinner, John Lazier, Belleville, C. W. ..... Dip.
2 portable steam engines, F. Colligan, Buffalo..... Dip.
Stave dresser machine, stave jointer, and panel planer, E. & B. Holmes, Buffalo..... Dip.

* As this class of implements were tested at the Auburn trial in 1866, it was not the purpose of the Society to make awards on such implements this year. These awards will be submitted to the Executive Board for their decision.

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Rotary pumps (hand and power), D. E. Kast, Mechanicsburgh, Pa..... Dip.
Washer and wringer combined, R. C. Browning, New York..... Dip.
Best brick machine for common brick, Empire State Brick Machine Co., Schenectady..... Dip.
Sugar mills, "Favorite," "Sampson" and "Croncher," No. 2 horse power, feed table and carrier, evaporator and furnace, Buffalo Agricul. Works, Buffalo..... Dip.
Wood sawing machine, Francis Brossy, Detroit, Mich..... Dip.
Combined shingle and heading machine, steam equalizer, Trevor & Co., Lockport..... Dip.
Cotton gin and condenser, saw mill, H. L. Emery & Son, Albany..... Dip.
Brick dressing machine, James McNamara, Buffalo..... Dip.
Hand loom, A. O. Very, Andover, Allegany county, N. Y..... Dip.
Portable cider mill, Mason Hill, Eden, Erie county, N. Y..... Dip.
Single block shingle machine, 2 block shingle machine, wood splitter, shingle joiner, wood saw table, Pierce & Co., Buffalo..... Dip.

Buffalo, *October* 5, 1867.

I certify that the award made by the New York State Agricultural Society, to Pierce & Co., for their shingle machine, was in consequence of its character as a rapid working machine. It is a double machine, cutting at both ends. Its motions are all very rapid and well performed, and does its work in an excellent manner.

(Signed) HENRY WATERMAN,
Consulting Engineer N. Y. State Agricultural Society

Wood sawing machine, N. Brockway, Cambria Centre, Niagara county, N. Y..... Dip.
Iron clad brick machine, best machine for front brick, J. A. Lafler, Albion, Orleans county..... Dip.
Force pump, Derrick & Peck, Jordan, N. Y..... Dip.
Cider press, Blymer, Day & Co., Mansfield, Ohio..... Dip.
Cook's sugar evaporator, Blymer, Day & Co., Mansfield, Ohio..... Dip.
Portable steam engine, the best for agricultural use, E. W. Mills, Syracuse, N. Y..... Dip.
Log cross-cut sawing machine, circular sawing machine, saw guide and log holder, fence cap boring machine, White & Bostwick, Norwalk, Ohio.. Dip.
Rotary pump, B. F. Taber, Buffalo..... Dip.
Portable saw mill, for wood, fences and farm use, White & Bostwick, Norwalk, Ohio..... Dip.
Empire wind mill, Empire Wind Mill Co., Syracuse..... Dip.
Water elevator (Brown's pat.), R. C. Brown, West Edmeston, N. Y..... Dip.
Combined washer and wringer, E. C. Patterson, Rochester..... Dip.
Buckeye premium cider mill, Thomas & Mast, Springfield, Ohio..... Dip.
Mangle, Ira Catlin, Buffalo..... Dip.
Improved meat cutter, John E. Smith, Buffalo..... Dip.
Improved water filter and pump, Wm. H. Wiley, Fredonia, N. Y..... Dip.
Wool press, Briggs & Gwin, Hamburgh, N. Y..... Dip.
Ditching machine, Henry Carter, Aylmer, C. W..... Dip.
Trojan Flexible washboard machine, wringing machine, Thos. Smith, Harlem, N. Y..... Dip.

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Combined drag and circular wood-sawing machine, J. W. Mount, Medina, N. Y..... Dip.
Stewart's oscillating saw hangings, D. Crawford, Buffalo..... Dip.
Combined wood-sawing machine, Reynolds & Totman, Fredonia, N. Y.... Dip.
Hay press, a perfect article, Buffalo Scale Works, Buffalo..... Dip.
Agricultural cauldron and steam boiler, D. R. Prindle, East Bethany, N. Y. Dip.
Best set barrel machines, Cool & Ferguson, Glens Falls, N. Y..... Dip.
Tile machine and ditching machine, A. La Tourette, Waterloo, N. Y..... Dip.
Washing machine, E. Judson, Cambridge, Washington county, N. Y..... Dip.

BUFFALO MANUFACTURES.

BUFFALO, *October* 5, 1867.

To Editors Buffalo Courier:

Gentlemen—I cannot leave your city without bearing special testimony to the superior excellence of many, and indeed most of the specimens of industry exhibited by your manufacturers at the Fair of the State Agricultural Society just closed.

Among the first I would mention the extensive collection of Pratt & Co., which, indeed, was so comprehensive that it is difficult to speak discriminatingly. All the specimens of their iron were highly creditable, showing great perfection in the art of iron manufacture.

Mr. David Bell's exhibition of machinery was also very fine. His tug-boat engine I would confidently recommend as a first-class article, well finished, and having all the appliances necessary to completeness. The steam hammer is one of the most simple machines of its kind ever exhibited. In the new propeller wheel I recognize all the points of formation that thorough experience would indicate. His boat models show a keen eye to speed and carrying capacity; and judging from the machinery exhibited by Mr. Bell, I should regard his establishment as a source of pride to your city.

The Buffalo Scale Works showed a very superior collection of scales of their own manufacture; and I take great pleasure in stating that their platform scale, after a very severe test, gave indications of excellence far superior to our expectations. Its adjustment was perfect in every particular; and in the trial with 8,000 pounds upon the platform, two ounces only were required to move the lever through its entire range.

The exhibition of planing and lumber-dressing machines, by Frank & Co., was highly creditable.

Davenport & Nelson's section of boiler, showing specimens of rivetting work done by machinery, can only be approved by the engineer.

Colligan's portable steam engines, and the numerous specimens of the Buffalo Agricultural Works, are also deemed worthy of especial mention.

The Buffalo Dental Manufacturing Company's specimens of instruments and machinery were of the most approved kind. Their new instrument for teeth-filling I consider an excellent invention.

The stave-dressing machine of E. & B. Holmes is efficient, and well adapted to that particular branch of industry.

In most of these classes the committees regretted that by the printed rules they were prevented from awarding anything better than the Society's diplomas, which are at present their highest certificates of merit, and felt that something more than an ordinary recognition is due to these contributors. And, finally, it must be a

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source of satisfaction to your citizens to know that they have in their midst so fine a body of excellent mechanics, who really constitute the heart of this great city.

Very respectfully,

HENRY WATERMAN,
Consulting Engineer N. Y. State Ag. Society.

CLASS V—GRAIN, SEED, VEGETABLES AND DAIRY.

No. 27. (A) GRAIN AND SEEDS.

Best sample white winter wheat, 1 barrel, grown present year, E. A. Horton, Collins, N. Y.	$5
2d best, O. Howland, Auburn	3
Best sample red winter wheat, 1 barrel, Wm. P. Ottley, Phelps, Ontario county	5
2d best, J. Corbin, Liverpool, Onondaga county, N. Y.	3
Best sample of rye, H. Schoonmaker, Cedar Hill, Albany county	5
Best sample of oats, R. L. Howard, Buffalo	5
Best sample of winter barley, O. Howland, Auburn	5
Best sample of spring barley, Wm. P. Ottley, Phelps	5
2d best, O. Howland, Auburn	3
Best sample of Indian corn, 1 barrel, shelled, Wm. P. Ottley, Phelps	5
Best sample timothy seed, 1 bushel, raised present year, O. Howland, Auburn	3
Best 12 ears yellow seed corn, R. L. Howard, Buffalo	3
2d best, Benj. Birdsell, Mendon Center, Monroe county	2
Best 12 ears white seed corn, O. Howland, Auburn	3
Best 12 ears sweet corn, E. S. Hayward, Rochester	3
2d best, S. W. Loper, Town Line, Erie county	2
Best sample of hops, F. W. Collins, Rechester, N. Y	3

ALONZO RICHMOND,
J. S. HULBERT,
WM. SIMPSON, JR., *Judges.*

No. 27. (B) VEGETABLES.

Twelve best stalks of celery, James Haldane, Buffalo	$3
2d best, George Cooper, Rochester	2
Six best heads of cauliflower, Geo. Cooper, Rochester	3
Twelve best white table turnips, Geo. Cooper, Rochester	3
2d best, James Haldane, Buffalo	2
Twelve best carrots, Geo. Cooper, Rochester	3
2d best, Robert Frazier, Cold Spring, N. Y	2
Twelve best beets, James Haldane	3
2d best, James Haldane	2
Twelve best parsneps, Geo. Cooper	3
2d best, James Haldane	2
Twelve best onions, James Haldane	3
2d best, James Haldane	2
Six best heads cabbage, James Haldane	3
2d best, Geo. Cooper, Rochester	2
Twelve best tomatoes, Wm. C. Allen, Black Rock	3
2d best, James Franklin, Buffalo	2
Two best purple egg plants, John Tackle, gardner for M. P. Bush, Buffalo,	3

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Best half peck Lima beans, Wm. C. Allen, Black Rock..... $3
2d best, Geo. Cooper, Rochester..... 2
Best 3 heads lettuce, Geo. Cooper, Rochester..... 3
Best 12 summer radishes, Geo. Cooper, Rochester..... 3
Best 12 winter radishes, Geo. Cooper, Rochester..... 3
Best bunch double parsley, Geo. Cooper, Rochester..... 3
Best 3 Hubbard squashes, James Haldane, Buffalo..... 3
2d best, Enoch Thomas, Buffalo..... 2
Three best large squashes, James Haldane, Buffalo..... 3
2d best, Wm. H. Davis, Springbrook, Erie county, N. Y..... 2
Best field pumpkin, James Haldane, Buffalo..... 3
Best half peck of table potatoes, John Benstead, Buffalo..... 3
2d best, Wm. H. Davis, Springbrook, Erie county..... 2
Best and greatest variety of vegetables, presented in best condition, raised by exhibitor, James Haldane, Buffalo..... Dip.

E. S. HAYWARD,
BENJ. BIRDSELL,
M. M. SMITH, *Judges.*

No. 28. FLOUR, &c.

Best barrel flour, Charles W. Platt, Alden Center..... Dip.
Best barrel flour (spring wheat), L. Enos & Co., Buffalo..... Dip.
Best barrel crackers, Ovens & Tracy, Buffalo..... Dip.
Best sample of preserved fresh fruits, with a description of the process used in their preparation, W. J. Smith, Lockport..... Dip.
2d best, D. W. Wright, Hamlin, Monroe county..... Trans.

F. W. COLLINS,
J. E. LOWING,
A. H. TRACY, *Judges.*

No. 29. (A) BUTTER.

Best 25 pounds of butter, made in June, John S. Shattuck, Oxford Chenango county, N. Y..... $15
2d best, J. S. Holbert, Chemung, N. Y..... 10
3d best, E. Rose, Delhi, Del. Co., N. Y..... Trans.
Best 50 pounds, made at any time, J. S. Holbert, Chemung, N. Y..... 15
2d best, Amos Goulding, Le Ray, Jefferson county..... 10
3d best, A. P. Bowman, Bradford county, Pa..... Trans.
Best barrel of salt for dairy purposes, Onondaga Salt Co., Syracuse..... Dip.
Best bag of salt for table use, Onondaga Salt Co., Syracuse..... Dip.
Best barrel of coarse salt for packing, Onondaga Salt Co., Syracuse..... Dip.

Discretionary.

Sample coarse salt, Goderich Salt Co, Goderich, C. W..... Dip.
June butter, Linas Stillman, Homer..... Trans.

GIRLS UNDER 21 YEARS OF AGE.

Best lot of butter, Miss. E. G. Holbert, Chemung, Chemung Co., N. Y..Silv. cup.

No. 29. (B) CHEESE.

Less than One Year Old.

Best 100 pounds, O. C. Crocker, Binghamton..... $15
Best cheese vat and heater, Wm. Ralph & Co., Utica, N. Y..... Dip.

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2d best, O. O'Neill & Co., Utica, N. Y..... ..... Trans.
Best sample factory made cheese, A. & H. Ackerly, Rushford, Allegany county, N. Y..... .....Dip. and $20
2d best, J. & S. Kinsey, Darien Centre..... 10
3d best, Henry Atwood, Lancaster..... Dip.

Special.

Chedder cheese, F. W. Collins, Rochester..... $30
Sage Cheese, O. C. Crocker, Binghamton..... ..... Dip.

REPORT OF THE DAIRY COMMITTEE.

The following report, made by the committee on butter, cheese, &c., is interesting enough for publication entire:

STATE FAIR GROUNDS,
BUFFALO, *October* 4, 1867.

To B. P. JOHNSON, *Secretary*:

SIR—Your committee, appointed to examine and report on butter, cheese, butter firkins, cheese reels and suet, at the New York State Agricultural Fair, held at Buffalo, October 1st, 2d, 3d and 4th, 1867, report: That upon entering upon the discharge of our duty, we found awaiting our examination the largest amount of butter by far that was ever presented at a State Fair before. On enquiring the reason for this unusual display, we found that it was mainly for the purpose of testing the relative values of the factory filled dairy salt of Onondaga and the Ashton salt as preservatives of butter; and we concluded that under these circumstances it was our duty to make a thorough and careful examination, and we accordingly devoted the most of Wednesday and Thursday to this subject alone. Butter for this purpose was produced from many counties of the State in duplicate lots, each dairyman sending one tub or firkin packed with Ashton, and one with factory filled dairy of Onondaga, and in no instance of our examination were we told the salt used until we had decided the question of the quality of the butter. We deem it of importance here to give the names and location of the parties making this butter, as their well-known names and reputation will be an abundant guarantee, that, so far as they are concerned, the test has been honestly made: J. F. Deming of Hooper, and Jonas Prentice of Chenango, in Broome county; Albert Seely of Southport, in Chenango county; A. P. Beardsley and E. Rose, of Delhi, Delaware county; Charles Frank, C. F. Davis and Harlon Mitchell, of Busti, Chautauqua county; Porter Welsh of Gowanda, Cattaraugus county; E. O. Van Buren and F. H. Smith, of Governeur, St. Lawrence county; Lewis Juliand of Greene county: John S. Shattuck of Norwich; Lewis Peck of Unadilla, Otsego county; E. M. Haynes of Chenango county; Linas Stillman and Alfred Chamberlain of Homer, and A. P. Rowley, agent, of Cortland, Cortland county; Albert Tuttle of Ashland, and G. B. Moss of Prattsville, Greene county; J. F. Cail and E. M. Mills of Orange county; A. Petrie of Lewis county; A. P. Bowman, Abraham Buchanan and John Ray, of Bradford county, Pennsylvania; Samuel Crumb of Bath, Steuben county, and William Gibbs of Norwich, Chenango county, were the men who had duplicate packages, as we have before mentioned, and whose certificate of the kind of salt used lay before us in each case, so that we made no mistake in regard to the kind of salt used.

The butter was, taken as a whole, of a very fine quality, and well sustained the reputation of the individuals and their several counties; but, of course, there was a marked difference as between each—though none need be ashamed of his dis-

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play. We pronounced in twenty-five cases the butter cured with factory filled dairy salt, made at the New York Mills, Syracuse, to be the best, as compared in each case with its alternate package cured in the same dairy with Ashton, but in no instance did we judge that any shortcoming was attributable to the quality of the salt used, but rather to the working of the butter and the quantity of salt used. In five cases the Ashton cured butter was the best. We have no doubt that for the preservation of butter the factory filled dairy salt has no superior; and we think that this careful and rigid examination must satisfy our farmers that they can safely rely on our own domestic salt, made purposely for the dairy; and if there is any failure in the butter, they will have to look to other causes for that failure. We were very much impressed with the fine, clean and well arranged manner in which this butter was packed, and with the marked evenness in quality, color and firmness through the whole tub or firkin, and we would have been glad if all our dairymen in the State could have been there to see.

Of the butter exhibited for premiums, we found only one package on exhibition under the first head, to wit: "Best lot (quality as well as quantity considered) made from five cows in thirty consecutive days, &c.," and that was not suitable for commendation. The butter examined for premiums was all first class, well made butter, and it was a very difficult matter to determine between the lots. We finally awarded to John Shattuck, of Norwich, Chenango county, the first; to Joshua S. Holbert, of Chemung, Chemung county, the second premium for the best twenty-five pounds of June made butter; and while we would like to have gone very much further in our commendation of the butter made for the salt test, we thought proper (at least under this head), to recommend a volume of Transactions of the Society to E. Rose, of Delhi, Delaware county, and Linas Stillman, of Homer, Cortland county.

For the best fifty pounds of butter, made at any time, we award to Joshua S. Holbert, of Chemung county, the first; to Amos Goulding, of Leray, Jefferson county, the second; and A. P. Bowman, of Bradford county, Pa., a volume of Transactions.

For the best lot of butter, not less than ten pounds, made by girls under twenty-one years of age, we award to Miss E. G. Holbert the first.

There was not such a display of cheese as we hoped to find, and none of a year old and over. Mr. Crocker having cheese on exhibition withdrew from the examinations, and Mr. Joshua S. Holbert, at the request of the other two judges, acted in his place.

The only ordinary made farm cheese on exhibition less than one year old was from Col. O. C. Crocker, of Binghamton, Broome county, to whom we awarded the first premium. Col. Crocker had on exhibition a sage cheese, in which the sage was placed so evenly and in such proportion as to make the cheese very palatable and rich. We take pleasure in recommending to him a volume of Transactions for this cheese.

For the best sample of factory made cheese, we award to A. & H. Akerly, of Rushford, Allegany county, the first; to J & S. Kinsey, of Darien Center, the second; and to Henry Atwood, of Lancaster, Erie county, the third premium.

Mr. F. W. Collins, of Rochester, Monroe county, exhibited an article of cheese made by him on his farm in Butternuts, Otsego county, and called American Chedder. This cheese is in small sizes, varying from nine to twelve pounds each. The skin of the cheese is very thin, while it is so close and impervious to the air

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as to hold the inside of the cheese soft and in good condition. This cheese we look upon as a great and valuable addition to the kinds of cheese made in our country. And under the circumstances we recommend for Mr. Collins a special premium of thirty dollars.

We awarded the first premium for cheese vats and heaters to William Ralph & Co., of Utica, and the second to O. O'Neill, of Utica.

Among other matters entrusted to your committee was the article of salt we found on exhibition—the different varieties made at the salt works of our State, at Syracuse, and one specimen from Goderich in the Province of Canada. The salt made at Goderich is from water recently discovered there, and only one manufactory is in operation, making by the boiler process. The specimen on exhibition is very clear, white salt, but is very fine grained and damp. Your committee is of the opinion that the grain has been effected by artificial means, which while it alters the grain, does not benefit the salt, but causes it to hold moisture, and thus renders it heavier than if it were pure and dry salt. There are on exhibition of the Onondaga salts the coarse screened, separating the coarse from the fine, thus making two kinds, one, the "coarse," for packing beef and pork, and the other, "the fine," for packing fish. We only reiterate in regard to these salts, the result of past experience, that of all known salts, they are fully equal, if not superior for these purposes; and we are gratified to learn that particularly for the purpose of packing fish, the F, or fine screened, is taking decidedly the lead in New York, Gloucester, Boston, and other fish markets. The common boiled salt on exhibition, is the finest of that kind we have ever seen—a nice, dry, even salt, all that can be asked for the ordinary and common purposes for which salt is used.

We come now to an article of salt manufactured by the Salt Company of Onondaga, which more nearly and intimately interests the farmers and the people generally, that is the dairy, or butter and cheese salt. Of this kind they have two specimens on exhibition, one manufactured from boiled salt, and the other from solar made or coarse salt—the first called Factory Filled New York Mills Salt, the other, Excelsior Mills Salt. In examining this salt, we have been rigid and careful. We find both of them, in color, taste and strength, equal to any salt we have ever seen; and while we have no question that either are equal in their curative and preservative qualities, to any known salt, there is apparent this simple difference between them; the dairy salt made from coarse, is a harder, weightier salt, and will not dissolve as readily as the other, but there is no difference in the quality. We would say in this connection, that care should be taken in their use, for either is a heavier salt than the ordinary foreign or Ashton salt, but we unhesitatingly pronounce that either are the equal of Ashton for the preservation of butter or cheese.

Under the arrangements now and for the last seven years in existence in Syracuse, by which the entire salt interests are under one management, there has been a marked improvement in the manufacture, and a regard paid to the quality of the article, which has resulted beneficially to the consumers until now. All that can be asked in the future is that the standard be kept up, and not permitted to fall back as it was a few years ago, leaving to a few the credit of making good salt, while the mass merely made to sell. The uniformity of the different kinds is plain, and should by all means be sustained and continued. In conclusion, your committee would recommend the various kinds of Onondaga salt for such premiums as the Society awards, and will venture to suggest that a careful regard to the

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kind of salt called for by the farmer, when he purchases Onondaga salt will result in his obtaining for the package of his beef and pork, or for the preserving of his butter and cheese, a salt which has no superior in the world, and to the Goderich salt a diploma.

All of which is respectfully submitted,

O. C. CROCKER,
G. W. BUCK,
JAMES R. CROFOOT, *Com.*

No. 29. (C) SUGAR AND HONEY.

Best 25 pounds maple sugar, Amos Goulding, Le Ray, Jefferson county...	$5
2d best, Horatio Graves, Wethersfield Springs, Wyoming county.....	3

HONEY.

Best 20 pounds honey, Mrs. Wm. Harris, Buffalo	$5
2d best, Peter Miller, Fredonia, Chautauqua county.....	3
3d best, Wm. Harris, Buffalo.....	Trans.
Best bee hive, W. A. Flanders, Shelby, Ohio.....	Dip.

H. S. HUNTLEY,
J. G. HARRIS,
MISS L. C. GAYLORD,
MRS. ANNA F. CHAPMAN, *Judges.*

CLASS VI.—DOMESTIC MANUFACTURES, &c.

No. 30. (A) SILK AND WOOLEN GOODS—No. 1.

Best pair woolen blankets, Mrs. G. W. Payne, North Buffalo.....	$5
Best 10 yards woolen cloth, Mrs. Wm. H. Graves, Blossvale Oneida Co...	8
2d best, Mrs. M. Dick, Buffalo.....	6
Best 10 yards woolen flannel, Mrs. H. Johnson, Mill Grove, Erie Co., N. Y.	8
2d best, Mrs. Wm. H. Graves, Blossvale.....	6
3d best, Eli Webster, East Hamburg, Erie county, N. Y.....	4
4th best, Oliver Allen, Mumford, Monroe county, N. Y.....	Trans.
Best rag carpet, 10 yards, Mrs. H. G. Hassey, Buffalo.....	5
Best 10 yards woolen flannel, cotton warp, Mrs. W. H. Graves, Blossvale.	8
Best 10 yards plaid flannel, Mrs. H. Johnson, Mill Grove, Erie county ...	8
2d best Mrs. M. Dick, Buffalo.....	6

Discretionary.

Cassimeres, Oliver Allen, Mumford, Erie county, N. Y.....	Dip.
Lap rug, Miss M. Love, Buffalo.....	Dip.
Table mats, Mrs. John Nicholson, Buffalo.....	Dip.
Gentleman's shawl (home-made), Miss Maria A. Ross, Newport.....	Dip.
Pair woolen kersey blankets, Mrs. W. H. Graves, Blossvale, N. Y.....	Dip.
Factory-made flannel (white), 10 yards, Oliver Allen, Mumford.....	Dip.
Wove bed spread (wool and cotton), Miss Anna Gillman, Cheektowaga, Erie county	Dip.
Several pieces cassimere were exhibited by the Niagara Woolen Company, Lockport, N. Y.....	Dip.

MRS. GEN. BARRY,
MRS. E. G. SPAULDING,
H. G. DICKINSON, *Judges.*

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No. 30. (B) DOMESTIC MANUFACTURES—No. 2.

Best double carpet coverlet, Mrs. H. Miller, Buffalo	$5
2d best, Mrs. M. Dick, Buffalo	3
3d best, Mrs. G. W. Payne, North Buffalo	2
Best knit bed spread, Mrs. M. Le Ritt, Buffalo	3
2d best, Mrs. George Day, Buffalo	2
3d best, Mrs. Eliza H. Daley, Buffalo	1
Best white quilt, Miss J. M. Stevens, Buffalo	3
2d best, Miss E. Laible, North Buffalo	2
3d best, Mrs. H. Hewitt, Lancaster, N. Y	1
Best six skeins woolen stocking yarn, Mrs. W. H. Graves, Blossvale	2
2d best, Mrs. M. Dick, Buffalo	1
Best pair woolen knit stockings, Mrs. W. H. Graves, Blossvale	2
2d best, Mrs. W. H. Graves, Blossvale	1
Best pair worsted knit stockings, Miss C. D. Alden, Binghamton	2
Best pair woolen fringe mittens, Mrs. M. Dick, Buffalo	2
Best striped mittens, Mrs. W. H. Graves, Blossvale	2
2d best, Mrs. W. H. Graves, Blossvale	1
Best balmoral skirt, Mrs. W. H. Graves, Blossvale	3

E. F. BROWN,
MRS. E. F. BROWN,
MRS. W. W. ROWLEY, *Judges.*

No. 30. (C) DOMESTIC MANUFACTURES—No. 3.

Best ten yards linen, Mrs. W. H. Graves, Blossvale, Oneida county	$8
2d best (linen table spread), Mrs. D. K. Ross, Newport, Herkimer county, N. Y	6
Best ten yards tow cloth, Mrs. M. Dick, Buffalo	4
Best ten yards twilled bagging, Mrs. W. H. Graves, Blossvale	6
Best pair linen knit stockings, Mrs. H. Miller, Buffalo	2
2d best, Mrs. G. W. Payne, North Buffalo	1
Best pound linen sewing thread, Mrs. W. H. Graves, Blossvale	2
2d best, Miss C. D. Alden, Binghamton	1

MRS. J. F. FARGO,
MISS LUCY LORD,
JAS. E. BROWN, *Judges.*

No. 31. (A) NEEDLE WORK, &c.—No. 1.

Best collar and sleeve embroidery, Miss F. Beebe, Watertown	$3
Best lace embroidery, Mrs. Margaret Hanley, Buffalo	3
2d best, Mrs. Antonio Pellegrini, Buffalo	Robinson's Cook Book.
2d best muslin embroidery, Mrs. Samuel Russell, Buffalo,	Robinson's Cook Book.
Best specimen Turkish emboidery, Mrs. Henry Friend, Buffalo	3
2d best, Mrs. E. H. Daley, Buffalo	Robinson's Cook Book.
2d best crotchet shawl, Mrs. Hemann, Buffalo	Robinson's Cook Book.
Best specimen hair jewelry, Miss A. Mischka, Buffalo	3
2d best, Wm. Leech, Buffalo	Robinson's Cook Book.
Best silk embroidery, Mrs. John Trifts, Buffalo	3
2d best, F. J. Alberger, Buffalo	Robinson's Cook Book.
Best chenielle embroidery, Miss F. Beebe, Watertown	3

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2d best, Miss C. D. Alden, Binghamton..... Robinson's Cook Book
Best embroidered tidy on black canvass, Mrs. F. Beebe, Watertown..... 3
Best crotchet embroidered Affghan, Mrs. F. F. Curry, and Mrs. Jas. Butman, Buffalo..... 3
2d best, Mrs. L. M. Kenyon, Buffalo..... Robinson's Cook Book.
Best knit sofa cushion, Mrs. James Parsons, Buffalo..... 3
2d best, Miss Mary L. Weld, Lockport..... Robinson's Cook Book.

MRS. J. G. MASTEN,
MRS. E. G. SPAULDING,
J. M. WILLETT, *Judges.*

No. 31. (B) NEEDLE WORK, &c.—No. 2.

Best specimen worsted embroidery (Last Supper), Mrs. John Wilcox, Rochester..... 3
2d best, Mrs. S. Holmes, Buffalo..... Robinson's Cook Book.
Best chair, embroidered (cushion and back), T. Cary, Buffa. Robinson's Cook Book.
Best ottoman cover (embroidered), Miss C. D. Alden, Binghamton..... 3
2d best, Miss A. M. Dunn, Williamsville, Erie county.... Robinson's Cook Book.
Best ornamental shell work, Mrs. John Nicholson, Buffalo..... 3
2d best, Wm. Leech, Buffalo..... Robinson's Cook Book.
Best specimen wax flowers, Miss A. De Ette Bloodgood, New York..... 3
2d best, Mrs. F. L. Derrick, Buffalo..... Robinson's Cook Book.
Best bead work, Miss Maria Davis, Buffalo..... 3
2d best, Miss Abbey C. Carew, Buffalo..... Robinson's Cook Book.
Best silk quilt, Mrs. C. Jeffrey, Buffalo..... 3
2d best, Mrs. L. Flint, Buffalo..... Robinson's Cook Book.
Best patchwork quilt, Miss E. Laible, North Buffalo..... 3
2d best, Mrs. S. A. Walker, Buffalo..... Robinson's Cook Book.
Best patchwork quilt, by girl under twelve years, Miss Constance G. Roberts, Buffalo..... 3
2d best, Miss Maria A. Ross, Newport, Herkimer county.. Robinson's Cook Book.
Best agricultural wreath, Mrs. John Nicholson, Buffalo..... 3
Best specimen wax fruit, Mrs. John Nicholson, Buffalo..... 3

Discretionary.

Best feather-flower wreath, Mrs. E. Varney, Buffalo.... Robinson's Cook Book.
2d best, Miss Delia Crittenden, Buffalo..... Pardee.
Large and superior collection of bead work, Michael Solomon, Versailles, Cattaraugus county..... Trans.
Shell picture frame, Mrs. E. Hemans, Buffalo..... Robinson's Cook Book.

MRS. J. G. MASTEN,
MRS. E. G. SPAULDING,
J. W. WILLETT, *Judges.*

CLASS VII—MISCELLANEOUS DEPARTMENT.

No. 31. (A) PAINTINGS, &c.

Best specimen of animal painting in oil, by American artist, G. W. Harris, Lancaster, Erie county..... L. B. Medal.
Best fruit drawing, F. W. Collins, Rochester..... Dip.
Best fruit painting, Miss C. H. Maynard, Buffalo..... Dip.
Best wood engravings, L. O. Mix, Buffalo..... Dip.

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Best lithographs, R. Van Dusen, Buffalo ..... Dip.
Best collection of photographs, O. B. Evans and wife, Buffalo..... Dip.
Best collection of ambrotypes, G. W. Harris, Lancaster, Erie Co., N. Y... Dip.
Best specimen of ornamental penmanship, Bryant & Stratton, Buffalo.... Dip.
2d best, S. N. Potter, Buffalo..... Trans.
Best specimen of business penmanship, Bryant & Stratton, Buffalo..... Dip.
Best specimen of sign painting, C. Smith, Buffalo..... Dip.

Discretionary.

Collection of oil paintings (very fine), Miss Lottie Crittenden, Buffalo....Pardee.
Collection of pencil drawings, R. W. Lester, Fredonia, Chautauqua county, Dip.
Specimens of crayons and penciling, A. V. Eddy, Akron, Erie county.... Dip.
Crayon drawings, F. Laird, Buffalo ..... Dip.
Oil paintings, Miss Jennie L. Alberger (15 years), Buffalo.....Pardee.
Crayon portrait (splendid), G. W. Harris, Lancaster, Erie county..... Dip.
Penciling (vase of flowers), W. P. Anderson, New York..... Dip.

E. P. K. SMITH,
MRS. JOHN NICHOLSON,
MRS. E. T. CROCKER, *Judges.*

REPORT OF SPECIAL COMMITTEE ON SPECIMENS OF PHOTO-LITHOGRAPH ON EXHIBITION.

The undersigned, having been appointed by the Executive Committee of the State Agricultural Society a special committee to examine the specimens of photo-lithography, presented by the American Photo-Lithographic Company, and to report their opinion of its value as a useful as well as a fine art, report:

That they have made as careful an examination of the specimens on exhibition as the limited time at their disposal would permit, and beg leave to present the following remarks as the result thereof:

The pictures are produced as follows: A negative is first made on glass in the usual way of taking them for ordinary photographic pictures. Suppose the original to be copied as a page of a book or an engraving, it is obvious that by the aid of the camera, the copy may be enlarged, or it may be diminished, or it may be reproduced of the exact size of the original. This great flexibility with respect to the size of the picture is of very great and obvious advantage, unapproachable by any other known process.

Another great advantage which this process possesses is the minute fidelity with which the copy represents the original. Every dot and mark, however minute or however trivial, is delineated with absolute accuracy; the defects as well as the excellencies are exactly imitated.

The negative possesses the property in the dark parts of absolutely preventing the transit of all the actinic rays, while the light parts permit the free passage of those rays.

These things being premised, we pass on to the next stage of the process. A solution of gelatine albumen and bichromate of potash is carefully mixed together and spread evenly over a sheet of paper, which is then permitted to dry in the dark. The nature of this mixture is such, that when thus dried, it is perfectly soluble in water, but absolutely insoluble in that fluid when the light has been allowed to act upon it. The paper, prepared in this way, is placed under the negative, and the rays of the sun are allowed to act upon it for a few moments

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The parts under the opaque parts of the negative remain soluble in water as before, while those under the transparent parts become absolutely insoluble. The whole surface of the paper is now smeared over with a fatty ink, specially prepared for the purpose, after which it is floated on boiling water, which coagulates the albumen. Its face is then washed in water, which has the effect of completely removing the soluble parts with the ink thereon, while the insoluble portions remain entirely unaffected, and retain their inky coating. We have now a positive picture of the light parts of the negative left black upon the white paper, a truthful photographic fac-simile in greasy lithographic transfer ink of the original drawing or engraving, modified or not in size, as the case may be.

The next thing is to place the inked picture with its face downward on an ordinary lithographic stone, and pass it under the press. When the paper is then removed the ink will be found adhering to the stone, and from such a transferred picture, after it has been subjected to the necessary treatment, two or three thousand copies can be printed, as in ordinary lithography, without any perceptible diminution of the sharpness, or the delicacy of the impressions. It will be remembered that the negatives are left unimpaired, and may be used again and again for the production of other and similar delineations on stone.

Having thus described the method of production, it remains to say, that the art has often been attempted by other persons, but has been only very moderately successful in all hands save those of Mr. J. W. Osborne, who has brought his process to very great perfection. We have seen copies of the finest works of art in European museums made by him so successfully that the best judges could scarcely decide between the original and the copy. The invention is now in the hands of the American Photo-Lithographic Company, of which the Hon. Ezra Cornell is president, and the great resources of the art are now brought to the aid of American artists, mechanics and scholars for the reproduction of their works with the utmost accuracy and cheapness.

It is adapted to meet the wants felt by a very large portion of the community.

First.—There are rare old books in the hands of collectors of almost priceless value, which may be printed in fac-simile by this process at a moderate cost.

Second.—Mechanical drawings may be multiplied with great rapidity, without the expense of engraving.

Third.—Lawyers' notes and minutes of evidenee, can be copied with absolute accuracy in a very short time, and with much less expense than to have them copied by hand.

Fourth.—All kinds of pen and ink drawings, maps, &c., can be multiplied at will, without the expense of engraving.

Fifth.—The engravings of such old masters as Albert Durer, &c., cannot be imitated by modern engravers; the works of the best artists cannot be copied by inferior ones. By this process the works by the best artists can be so accurately copied that no line or touch is missed by the most fastidious critic.

Sixth.—In copying old writings, some words are so obliterated as to be illegible. It is often the case that making a greatly enlarged copy, by this process, the necessary words become legible.

The applications of the art are almost inexhaustible. We specify the above as being the first which have occurred to us, but by no means as exhausting its capabilities. Thirty-five specimens of various kinds of work were suspended in the President's room, and proved a most interesting as well as an instructive feature of the fair.

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One of them is the original title page of a humorous work published by the Appletons, entitled "the Foreign Tour of Brown, Jones and Robinson." The copy was four times the size, and exactly proportional to the original.

A copy of the engraving of Marshall's portrait of Lincoln (published by Messrs. Ticknor & Field) is given three times the size of the original. Another very large plate is entitled "Crossing the Stream." A copy of Raphael's Cherubs, in all respects equal to the original; a head of Dante, and twelve pictures representing the months allegorically are exhibited. Also Dore's picture of the Crucifixion, and of the Apostles Gathering Corn on the Sabbath. All the pictures were perfect as copies, and really leave nothing to be desired.

We are truly gratified with the new art, and are deeply impressed with its importance, as opening a door for the cheap diffusion of the works of the best masters, so that they may henceforth be found in the cottage of the tasteful laborer, as well as in the mansion of the affluent. We are impressed with the conviction that it will have the happiest effect on all departments of the decorative art.

Calico printers, lace makers, paper hangers, architects, moulders of fancy iron works, sign and carriage painters, upholsterers, and all who are engaged in any of the departments of decoration, will have their tastes improved by the opportunity which this new art brings them of filling their minds with those lines of beauty which only the best masters have portrayed.

We are of opinion that the effect for good cannot be overrated, as in the competition into which our manufacturing industry must enter with the whole world, mind and taste must become the most important elements which determine success.

Hence, in an economical point of view, we cannot give this new art too warm a welcome, and in view of this result, we think the Executive Committee will agree with us that the gold medal of the Society should be awarded to the company for this exhibition.

JOHN STANTON GOULD,
PETER V. KING,
D. G. ELLIOT, *Committee.*

No. 32. Silverware, Cutlery and Britannia.

Best exhibition of table cutlery, American manufacture, Hadley & Nichols, Buffalo ..... Dip.
Best set dental instruments, Buffalo Dental Manufacturing Co., Buffalo... Dip.
Best specimen plated ware, Hadley & Nichols, Buffalo..... Dip.
Best family refrigerator, Jno. C. Jewett, Buffalo ..... Dip.
2d best, Gesellgen, Heinz & Co., Buffalo .....Trans.

Discretionary.

Water filter, cooler, and refrigerator combined, J. D. W. Wemple, Albany Dip.
Milk cupboard and refrigerator combined, James McKelvey, Suspension Bridge ..... Dip.
Patent silver syrup cup, J. A. Parise, New York ..... S. S. Med.
Case of silver-plated ware, Jewett, Church & Co., Buffalo..... Dip.

J. E. ELY,
F. W. LAY,
E. H. SELKREG, *Judges.*

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No. 33. STOVES (COOKING).

Best low oven cooking stove, for wood fire ("American"), Shear, Packard & Co., Albany..... Dip.
2d best ("Legislator"), Jewett, Church & Co., Buffalo.....Trans.
Best low oven cooking stove, for coal ("American"), Shear, Packard & Co., Albany..... Dip.
2d best ("Triumph"), G. B. Bull & Co., Buffalo.....Trans.
Best cooking range for families, L. Schwartz & Co., Buffalo..... Dip.
Best furnace for warming houses, economy of construction, consumption of fuel, security of premises, and facility for ventilation considered, L. Schwartz & Co., Buffalo..... Dip.

Your committee would respectfully recommend that a premium be awarded to Sheldon & Green, Troy, N. Y., for their mammoth "Olive Branch" cook stove..... Dip

H. S. JARVIS,
JAMES E. BROWN, *Judges.*

No. 33. STOVES (PARLOR).

Best ornamental parlor stove, Strong & McNeal, Buffalo..... Dip.
2d base ("Radiator"), Horace Parmelee, Buffalo.....Trans.
Best ornamental parlor stove for coal fire ("National Gas-Burner"), Shear, Packard & Co., Albany..... Dip.
2d best, A. Spitzmiller & Co., Buffalo.....Trans.
Best fire grates for dwellings, Strong & McNeal, Buffalo..... Dip.
Best and largest exhibition of stoves, Shear, Packard & Co., Albany..... Dip.
Best base-burning or self-feeding ornamental parlor stove, for coal fire ("Morning Light"), Shear, Packard & Co., Albany..... Dip.
2d best ("Sunbeam"), Horace Parmelee, Buffalo.....Trans.
Best hall stove, ventilation, preserving fire, and convenience generally considered, A. Spitzmiller & Co., Buffalo..... Dip.

H. S. JARVIS,
JAMES E. BROWN, *Judges.*

Discretionary.

The committee award a discretionary premium to J. C. Cochrane, Rochester, on the "Solartype Ventilating Coal Burner"..... Dip.

JOHN E. GARRETTSE, *Ch'n Judges.*

No. 34. LEATHER, INDIA RUBBER GOODS, &c.

Best specimens of trunks, Upright Patent Trunk Co., New York..... Dip.
Best sole and upper leather, Delitsch, Sigel & Co., Buffalo..... Dip.
Best calf skins, Delitsch, Sigel & Co., Buffalo..... Dip.
Best morocco for bookbinding, M. Strauss, Buffalo..... Dip.
Best leather hose for fires, Wm. Taylor, Buffalo..... Dip.
2d best, Bickford & Curtis, Buffalo.....Trans.
Best exhibition of boots and shoes, Jewett & Draper, Buffalo..... Dip.
Best exhibition of ladies' work, do., Jewett & Draper, Buffalo..... Dip.
Best single harness, John Humphrey & Brother, Buffalo..... Dip.

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Discretionary.

Exhibition of ladies' boots and shoes, Alex. Sutherland, Kingston, C. W.. Dip.
Superior sole leather, S. M. Welsh, Buffalo..... Dip.

E. S. HAYWARD,
V. P. BROWN, *Judges*

No. 35. (A) Cabinetware.

Best spring-bed, with adjustable head, J. C. Barnes & Co., Buffalo..... Dip.
Best spring-bed and bedstead, Mrs. Webster Smith, Syracuse..... Dip.
Best spring-bed bottom, Jas. R. Cole, Hoag's Corners, Rensselaer Co.... Dip.
Best spring-bed complete, Abner Hitchcock, Ypsilanti, Mich..... Dip.
Best spring-bed, Stewart Elder, Buffalo..... Dip.

A. W. ALLEN,
E. WARE SYLVESTER,
N. C. SIMMS, *Judges.*

No. 35. (B) Carriages.

Best single top buggy, D. C. Goodwin, Buffalo..... Dip.
Best single riding buggy, Bangert & Brothers, Angola, Erie county..... Dip.
Best double sleigh, Kingsbury & Whitehead, Albany..... Dip.
Best single sleigh, D. C. Goodwin, Buffalo..... Dip.
Best collection of carriages and wagons, D. C. Goodwin, Buffalo..... Dip.

EDWARD DAVEY,
W. D. KINGMAN,
DANIEL QUINN, *Judges.*

No. 36. (A) Clothing, Hats, Furs, &c.

Best exhibition of men's clothing, Storms & Furman, Buffalo..... Dip.
Best exhibition of boys' clothing, Storms & Furman, Buffalo..... Dip.
Best exhibition of men's hats and caps, Empire Hat Company, Watertown, Dip.
Best exhibition of ladies' hats, Mrs. P. Lies, Buffalo..... Dip.
Best collection of furs, L. A. Serret, Buffalo..... Dip.

JAMES W. JOLLY, *Ch'n Judges.*

No. 36. (C) Sewing and Knitting Machines.

Best family sewing machine, "Singer's," Russel Crego & Son, Utica ..... Dip.
Best machine for manufactories, "Singer's," Russel Crego & Son, Utica .. Dip.
Best double thread machine, "Florence," E. W. Gleason, Buffalo..... Dip.
Best sample of work on sewing machine, Bruen Manufacturing Company, New York ..... Dip.
Best knitting machine, "Rist's," J. W. Rist, Rochester..... Dip.
Best button-hole machine, "Singer's," Russel Crego & Son, Utica ..... Dip.

Discretionary.

Specimens work on Weed sewing machine, Weed Sewing Machine Co., New York..... Dip.
Superior work on sewing machine, Miss E. Cornish, Buffalo..Robinson's C. Book.

The committee give their special commendation to the knitting machine exhibited by Mrs. H. A. Vosseler, North Buffalo.

H. A. PARSONS,
E. L. MASSEY,
MRS. ROBT. HOLLISTER, *Judges.*

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BUFFALO, *Oct.* 6, 1867.

I cheerfully certify that I gave the machines made by the Howe Sewing Machine Company, together with the several machines exhibited at the late Fair of the State Agricultural Society, a critical examination, and I take pleasure in stating that it is a machine in every way worthy of Elias Howe, Jr., the original inventor, and is justly entitled to rank among the first class sewing machines.

HENRY WATERMAN,
Consulting Engineer, N. Y. S. A. S.

No. 37. PIANOS AND MUSICAL INSTRUMENTS.

Best parlor Grand, Clemens & Redington, Syracuse	Dip.
Best Square Grand, Central Piano Company of New York	Dip.
Best church organ, with more than one bench of keys, Clemens & Redington, Syracuse	Dip.
Best family organ, Clemens & Redington, Syracuse	Dip.
Best melodeon, Geo. A. Prince & Co., Buffalo	Dip.
Best collection of Musical instruments, Cottier & Denton	Dip.

Discretionary.

C. Beecher, of Buffalo, exhibits a splendid piano action, and the committee call especial attention to the same as a fine specimen of workmanship	Dip.

Your committee would especially commend the Estey organs for their smooth, round and full tone, their exceedingly quick articulation, and the delicacy of touch. The harmonic attachment for doubling the power, and the manual sub bass (both inventions of the Estey house), we deem the best on any organ.

We would particularly commend the vox humana tremolo. This invention imparts a sweetness and beauty to the tone that is inimitable, removing all harshness and all approach to a reedy quality of tone. Indeed, the character of the tone is entirely changed by the vox humana stop, and a wonderful purity and delicacy imparted in place of the usual reed nature of tone of all this class of instruments.

We deem it the only principle capable of producing a perfect tre

T. H. HINTON,
J. R. THOMAS,
GEO. FOLSOM,
WM. TRUER,
JAS. VAN WIER, *Judges.*

No. 38. (A) BREAD.

Best wheat bread, Miss Sarah Ryan, Buffalo	$5
Best rye bread, Mrs. Eli Webster, East Hamburgh	5
Best rye and Indian bread, Mrs. Eli Webster, East Hamburgh	5

Discretionary.

Loaf of wheat bread, Miss C. M. Balcom, Buffalo	Dip.

MRS. J. D. LELAND,
MRS. CHAS. E. BECKWITH,
MRS. N. P. PERKINS, *Judges.*

No. 38. DOMESTIC PURE WINES, &c.

Best native wine, Germania Wine Company, Buffalo	Dip.
Best pure cider (bottled), D. Ransom, Buffalo	Dip.
Syrups, brandies, wines and bitters, Dingens Brothers, Buffalo	Dip

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Native sparkling Catawba and Isabella wines (generated their own gases), Urbana Wine Company ..... Dip.
Isabella, Catawba, Delaware and Diana still wines (generated their own gases), Pleasant Valley Wine Company, Hammondsport, N. Y. ..... Dip.
Isabella, Catawba, Delaware and Diana sparkling wines, Pleasant Valley Wine Company, Hammondsport, N. Y. ..... Dip.
American brandy, distilled from grape wines (superior), entitled to special commendation, Pleasant Valley Wine Company, Hammondsport ..... Dip.
Light wines and cordials, sugared (ladies), Jacques Brothers, Blooming Grove, Orange county ..... Dip.
Ives' seedling wines (pure juice, nine and three-tenths per cent. alcohol), J. McCulloch, Cincinnati, Ohio ..... Dip.
American rhubarb cordials, Peter Miller, Fredonia, Chautauqua county ... Dip.
Assortment of still and sparkling wines, Lake Shore Wine Company, Brocton, Chautauqua county ..... Dip.

Discretionary.

In consideration of their uniform success in exhibiting wines and brandies for several years past, by the Pleasant Valley Wine Company, the judges recommend that they be awarded the Large Silver Medal for the best sample of sparkling wine (Paris Exposition) ..... L. Silver Medal

LEWIS F. ALLEN, *Ch'n Judges.*

No. 39. DISCRETIONARY.

Betts' rock shaft gate, James Gorris, Cleveland, O ..... Dip.
Telurian, Campbell & Washburn, Buffalo ..... S. S. Med.
Vessel signal lamps, Felthousen & Russell, Buffalo ..... S. S. Med. and Dip.
Patent adjustable and reversible heel for boots and shoes, L. & A. A. Hoffman, Buffalo ..... Dip.
Patent improved method of preparing hay and straw for horses and cattle, Charles Brown & Co., Buffalo ..... Trans.
Willow secretary and assortment of willow baskets, Volger, Reibeling & Co., Buffalo ..... Trans.
Window drapery, case of dry goods, &c., J. C. Barnes & Co., Buffalo ..... Dip.
Soap stone stoves, register frames, foot warmers, soap stone hand warmers, griddles, sad stones, marbleized slate mantles, decorated marble mantles, slate hearths, gas burning fire places, marbleized shelves, soap stone table tops, soap stone shelves, &c., Strong & McNeal, Buffalo ..... Dip.
Telescope rifle, two double fowling guns, double gun—shot and rifle, Patrick Smith, Buffalo ..... Dip.
Elastic sponge beds, pillows and cushions, and paper hangings, Montgomery Brothers, Buffalo ..... Dip.
Boat lamp, Fuller & Bray, Buffalo ..... S. S. Med.
Brewer's copper kettle, liquor pump, oil drainer, iron sink bottom, Louis Sellenreich, Buffalo ..... Dip.
Specimens of lubricating and burning oils, F. S. Pease, Buffalo ..... Dip.
Specimens of wood engraving, W. J. Mitchell, Buffalo ..... S. S. Med.
Head lights, steam gauges, signal lamps, pyrometer, railroad tail lamps, Buffalo Steam Gauge Company, Buffalo ..... Dip.
Water coolers and filters, J. C. Jewett, Buffalo ..... S. S. Med.
Sets of toilet ware, J. C. Jewett, Buffalo ..... S. S. Med.

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Bird cages, J. C. Jewett, Buffalo ..... Trans.
Glass show cards, L. Samuels, Buffalo..... Trans.
Patent music racks, M. H. Elmore, Buffalo..... Dip.
Models of iron steamers, David Bell, Buffalo..... Trans.
Dish washing machine, Samuel D. Sykes, Buffalo..... Dip.
Specimens of white lead, painters' and artists' materials, druggists' and medicinal oils, F. S. Pease, Buffalo ..... Dip.
Stained glass memorial window, W. H. Myers, Buffalo .....S. S. Med.
Specimens of washing soap, Lantz, Brothers & Co., Buffalo..... Dip.
Billiard table, L. Wacker, Buffalo.....Trans.
Patent pipe wrenches, John W. Close, Buffalo .... Dip.
Plumbers' goods and gas fixtures, Irlbacker & Davis, Buffalo.....S. S. Med.
Best town clock, E. Emrich, Rochester ..... Dip.
2d best town clock, Mathias Denz, Buffalo..... Dip.
Dimick's capillary balm, S. H. Dimick, Ypsilanti, Mich..... Dip.
Yeast cake, Buffalo Yeast Company, Buffalo.....Trans.
Combined stool, milk pail and strainer, James L. Drake, Boston, N. Y....Trans.
Tyler's patent hair crimpers, Miss E. A. Tyler, Buffalo.....Trans.
Cloth roller and measurer, Geo. R. McIntyre, Niagara Falls..... Dip.
Washing boiler and diving apparatus, J. D. Dudley, Buffalo..... Dip.
Boyd's improved patent ladder, Lester Day, Buffalo.....Trans.
Fruit-gathering baskets, American Fruit Basket Co., Westboro, Mass..... Dip.
Samples of bricks, P. A. Balcom & Son, Buffalo ..... Dip.
Ring's ambrosial for gray hair, E. M. Tubbs, Peterboro, N. H..... Dip.
Lanterns, patent oilers, firemen's trumpets, Bonnell & Gridley, Buffalo ... Dip.
Improved school furniture, W. Chase & Son, Buffalo..... Dip.
Bird and squirrel cages, Osborn Manufacturing Company, New York..... Dip.
Slate roofing, Roberts & McSheffrey, Buffalo.....Trans.
Ship tackle blocks, Chester P. Turner Buffalo ..... Dip.
Samples of lime, International Lime Company, Buffalo..... Trans.
Self-acting tuck creaser and guide, E. Bostock, Albany ..... Dip.
Case saddlery hardware, Pratt & Letchworth, Buffalo..... Dip.
Case malleable iron castings, Pratt & Letchworth, Buffalo.....S. S. Med.
Improved carriage-way gate (2d premium), Dixon & Close, Port Byron... Dip
American gate, Eli Petteys, Chester, Warren county, N. Y..... Dip.
Horse collar, J. H. Van Sice, Buffalo..... Trans.
Combination bank and safe locks, Charles Flesch, Rochester..... Dip.
Leather belting, Bickford & Curtiss, Buffalo..... Dip.
Improved shield for tube wells, Parker, Lapp & Co., Buffalo..... Dip.
Bread mixing and kneading machine, H. F. Forbush & Co., New York.... Dip.
Ornamental confectionery, Valentine Otto, Buffalo..... Dip.
Ornamental brass work for steam engine, F. Colligon, Buffalo..... Dip.
Model Emerson's patent windlass, model Ingersoll's patent metallic life boat, model Golding's patent life-preserving mattrass, Spaulding & Coffin's union power capstan, James M. Averell, Buffalo.....Trans. and Dip.
Shirrell's Kulliyan washing crystal, Shirrell, Fisher & Co., Buffalo..... Trans.
3 cards mouldings, E. & B. Holmes, Buffalo..... Dip.
Washing soap (2d premium), P. M. Dantzer, Buffalo ..... Trans.
Medley of steel engravings, Mrs. J. C. Cutler, Buffalo..... Trans.
Samples of shooks made by machinery, E. & B. Holmes, Buffalo..... Dip.

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Clothes' sprinkler, Charles A. Theobald, Buffalo..... Trans.
Artificial limbs, G. W. Hall, Buffalo..... Dip
Osier willow, oil-grained tubs, plain tubs, varnished keelers, willow clothes' baskets, willow hand baskets, fancy work baskets, willow clothes' hamper (colored), covered cedar basket, pails—assorted, two-hoop pails, blue and green, three-hoop pails—assorted colors, cheese tubs, F. P. Wood & Co., Buffalo ..... Dip.
Bank lock, L. Schwartz, Buffalo..... Trans.
Furguson's sash supporter and window lock, Clark, Ruger & Co., Buffalo. Dip.
Self-locking blind hinges, Shepherd & Clark, Buffalo..... Dip.
Clark's patent window sash lock and patent gravity sash lock, Clark & Co., Buffalo ..... Dip.
Cow milking machine, J. Hollingshead, Buffalo ..... Trans.
Hoop skirt, E. Hyman, Buffalo..... Trans.
Assortment of files, Bailey & Gillett, Buffalo..... Trans.
Blind fastenings, S. W. Woodward, Buffalo ..... Dip.
Eraser and pen holder combined, Morse, Eraser & Co., Philadelphia, Pa... Trans.
Sewing machine castor, H. R. Fauton, New York..... Trans.
Wire flower frames, wire flower baskets, wire flower vases, wire fence patterns, P. J. Kissel, Buffalo..... Trans.
Model for patent lime kiln, Chas. Hinkley, Williamsville, Erie county .... Dip.
Grained door, Joseph Berry, Buffalo..... Trans.
Bruen's attachment to Wheeler & Wilson Sewing machine, Bruen Manuf. Co., New York..... ..... Dip.
Patent beer faucets, F. P. Stiker, Buffalo..... Dip.
Patent barrel bung, Ritt & Miller, Buffalo..... Dip.
Spencer's patent self-sealing fruit jars, Coleman & Barnes, Rochester..... Dip.
Specimens of hardware from Rochester Novelty Works, S. Coleman & Co., Rochester..... Dip.
Household gas machine, W. H. Thomas, Washington, D. C..... Dip.
Tyrrell's hoof expanding horse shoe, Tyrrell & Ferren, Batavia, N. Y.... Trans.
Morse's hot air stove-pipe drums, H. S. Morse, Batavia, N. Y..... Dip.
Kedzie water filters, Kedzie & Bunnell, Rochester. ..... Dip.
Patent breast drill, clothes' dampeners, apple corer and slicer, patent ice pick, R. Onderdonk, New York..... Trans.
Embroidering machine, Russell Crego & Son, Utica ..... Dip.
Church and boat bells, Thomas H. Mills, Buffalo..... Trans.
Patent Dumping box, N. Clute, Schenectady..... Dip.
Spring for bed bottom, self-supporting farm gate, James R. Cole, Hoag's Corners, Rensselaer county..... Trans.
Model patent millstone pick, Wm. B. Stephens, Stephens' Mill, Steuben Co. Trans.
Model shingle bolter, 1000 shingles, Tho. Thompson, North Buffalo ..... Trans.
Cream strainer, Hiram Baker, Cortlandville, N. Y ..... Dip.
Universal extension step-ladder, American Ladder Co., Hamilton, Ohio... Dip.
Case locks, Townsend Manuf. Co., Buffalo..... Trans.
Dilts' patent self-holding plow attachment, L. & J. Beemer, Buffalo..... Trans.
Model double acting oil pump, John Sheffield, Buffalo..... Trans.
Folding portable fence, B. & V. Calkins, Varysburgh, Wyoming county.... Dip.
Natrona refined saponifer, Penn. Soap Manuf. Co., Pittsburg, Pa..... Dip.

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Soap made with natrona refined saponifer, Penn. Soap Manuf. Co., Pittsburg, Pa..... Dip.
European weeping mountain ash, with Snow apple leaf on top, European mountain ash, with oak leaf on top, Crawford flat trained peach tree, double crowned logustrum, weeping sabinas, wreath shape, weeping sabinas, standard weeper, union lilac, red, white and blue on one stock, Willam Nienwerf, Buffalo .....Trans.
Model of machine for flushing vaults, drains and sewers, Thomas Dark, Buffalo..... Dip.
Easy scrubber, B. Morahan, Buffalo ..... Dip.
Mop head, R. W. English, Buffalo ..... Dip.
Heavy wagon axletree, turned, forged car axletree, Henry Childs, Buffalo.. Dip.
Boat lamps, triangle lamps and anchor lamp, Felthousen & Russell, Buffalo, Dip.
Veranda archway, E. & B. Holmes, Buffalo ..... Dip.
Bulletin boards, James A. Dandridge, Buffalo .....Trans.
Corn husker, William Keach, Woonsocket, R. I ..... Dip.
Improved carriage wheel, E. Thrasher, W. Liberty, Ohio..... Dip.
Berry crates and baskets, B. N. Comings, New Britain, Conn ..... Dip.
Specimen steam packing, Snook & Patchell, Corning, N. Y ..... Dip.
Augurs and bit braces, Nobles Manuf. Co., Elmira ..... Dip.
Paper and pulp, fruit picker, pruning shears, Charles Ketchnm, Penn Yan. Dip.
Barrels, James A. Chase, N. Buffalo.....Trans.
Patent iron tackle block, J. W. Narcross, Boston, Mass..... Dip.
Clothes line attachment, J. W. Narcross, Boston, Mass..... Dip.
Improved anti-friction metal for bearings, William P. Jones, Troy..... Dip.
Collar's patent mower and reaper knife grinder, E. L. Bushnell, Poughkeepsie .....Trans.
B. B. Hawse's patent clothes' dryer, S. M. Davis' patent clothes' horse, Tainter's ventilating stove damper, Webster Smith, Syracuse.....Trans.
Model steam engine, Erie City Iron Works, Erie Pa.....Trans.
Bent buggy felloes, hickory spokes, carriage top bows, G. J. Letchworth, Auburn..... Dip.
Ross' patent skates, Duane A. Ross, Newport, N. Y..... Dip.
Model steam engine, John Barlow, Erie, Pa .....Trans.
Lanterns, Pengeot Brothers, Buffalo.....Trans.
Lifting jack, Eli Zimmerman, Pamelia, Jefferson county, N. Y.....Trans.
Bolt and rivet trimmer, L. J. Newlan, Waverly, N. Y .....Trans.
Universal crank latch, Universal Crank Latch Company, Owego..... Dip.
Patent wheel for wagons, carriages, &c., D. B. Goeway, Binghamton..... Dip.
Combined iron and wood fence, King Brothers, Painesville, Ohio..... Dip.
Fire extinguishers, U. S. Extinguisher Company, New York..... Dip.
Willow stand, R. Dickinson, Buffalo .....Trans.
Flour barrels, J. Getz & Co., Buffalo .....Trans.
Sleigh break, Teelin and Swift, Blossvale, N. Y.....Trans.
Low water alarm, engine governor, centrifugal pump, J. D. Dudley, Buff.. Dip.
Automatic barrel filler, W. S. Payne, Petroleum Centre, Pa..... Dip.
Atmospheric churn dasher (Gibson's patent), J. D. Husband, jr., Rochester, Dip.
Black walnut timber, new paint oil, hydraulic paint, model farm roller, model grass seed sower, model corn planter, preserved timber, model of portable fence, D. R. Prindle, East Bethany, N. Y..... Dip.

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Knot bowls, Wm. S. Young, Lockport ..... Dip.
Baugh's raw bone superphosphate, Baugh Brothers & Co., New York .....Trans.
Model of milk rack and table combined, John McCoun, Lockport .....S. S. Med.
Samples of tea and coffee, J. E. Francis, Buffalo..... Dip.
Milk agitator, G. Austin, Denmark, N. Y ..... Dip.
Specimen of picture frames, Briggs & Howard, Buffalo .....Trans.
Hero fruit jars, W. J. Smith, Lockport..... .....Trans.
Patent dumping wagon and self-acting brake, R. F. Randolf, Hamilton, N. Y. Dip.
Casket for preserving corpse, model of pot for sugar refining, steam boiler grate, horse fork pulley, D. W. Jones, Buffalo..... Dip.
Hay knife, H. M. Smith, Kalamazoo, Mich..... Dip.
Hitching post and step combined, Preston & Heermans, Corning, N. Y.... Dip.
Staple soap, R. W. Bell & Co., Buffalo..... Dip.
Horse and cut nail machines, in operation, Pratt & Co., Buffalo..... Dip.
Bent, twisted and pulled samples of iron, done cold, Pratt & Co., Buffalo, S. S. Med.
Weston's patent pulleys, Pratt & Co., Buffalo.....S. S. Med.
Cards of assorted carpenters' and machinists' tools, Pratt & Co., Buffalo .. Dip.
Case pocket cuttlery, Pratt & Co., Buffalo ..... Dip.
Slates, Breed & Lent, Buffalo.....Trans.
Rat traps, Henry Guidotte, Buffalo..... .....Trans.
Window sash supporter, William Morehouse, Buffalo..... Dip.
Card coach screws, Thomas Parks, Buffalo..... Dip.
Pair tweer irons, Geo. E. Morehouse, Decatur, Ill.....Trans.
Fire brick, Hall & Sons, Buffalo.....Trans.
Coil and cable chain, Seymour & Lacy, Buffalo..... Dip.
Nuts and bolts, Bell & Sherwood, Buffalo..... Dip.
Table cuttlery, Morse Cuttlery Co., Lockport.....Trans.
Trellis, W. W. Wilcox, Middletown, Conn .....Trans.
Frame around wreath of wax flowers, Frederick K. Trummel, Attica.....Trans.
Evans' patent domestic fanning process, O. B. Evans and wife, Buffalo....Trans.
Model of farm gate, S. C. Fuller, Rockford, Ill..... Dip.
Patent carriage wheels, M. L. Smith, Bergen, N. Y .....Trans.
Patent wear plates for boots and shoes, John Gray, E. Aurora, Erie Co...Trans.
Set three-horse whiffletrees, O. L. Pinney, Ripley, N. Y..... Dip.
Model of a wagon, L. F. Palmer, Ithaca..... Dip.
Patent self-fastening rail for buggy top, Henry F. Holt, Fredonia, N. Y... Trans.
Electrotyping, G. G. Newman, Buffalo..... Trans.
Hair felting, J. W. Narcross, Boston Mass..... Dip.
Model shifting rail for carriage tops, P. G. Clancey, Augusta, Me..... Trans.
Double continuous apple parer, E. Manley, Marion, N. Y..... Trans.
Syracuse mineral spring water, J. H. Rae, Syracuse..... Trans.
Ice cream freezer, J. H. Rae, Syracuse.....S. S. Med.
Model of peat machine, J. H. Rae, Syracuse.....S. S. Med.
Coffer grate, Cochrane's patent, J. C. Cochrane, Rochester..... Dip.
Sandgrene's pat. shear combined with a punch and iron upsetter, John J. Sandgrene, Columbus, O..... Dip
Reding's champion clothes reel, Carter & Ford, Troy ..... Trans.
Specimens of iron, Elmira Rolling Mill, Elmira ..... Dip.
Box of soap, H. Thompson, Buffalo ..... Trans.

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Case dentistry, F. H. McGeorge, Corning..... Dip.
Embroidered machine-made corset, Mrs. M. D. Tiffany, Jamestown, N. Y.. Trans.
Flat-iron heater, John H. Yates, Batavia ..... Dip.
Combined step and extension ladder, H. W. Covert, Rochester,..... Dip.
Bullard's dial attachment for stove pipe, Carrier's hoof and healing ointment, S. H. Welsher, West Webster, Monroe county ..... Dip.
Whip holder, C. L. Pierce, Buffalo..... Dip.
Corn basket, Lancaster Manuf. Co., Lancaster, N. Y..... ..... Trans.
Grindstone, for grinding mower and reaper knives, E. M. Scott, Auburn... Dip.
Deep well oil pump, E. Y. Kneeland, Buffalo..... Dip.
Grain shovels, E. Y. Kneeland, Buffalo..... ..... Dip.
Model of roof, E. Y. Kneeland, Buffalo..... Dip.
Extension ladder, Calvin Eaton Rochester..... Dip.
Spokes for carriages, Titus & Selover, Moravia, Cayuga Co., N. Y..... Trans.
Kerosene lamps, Buffalo Kerosene Lamp Co., Buffalo ..... Dip.
Vulcanizer and rubber packer, A. B. Woodward, Alfred Centre, N. Y .... Trans.
Carriage spokes, S. D. Shutts, Penn Yan..... ..... Trans.
Carpet stretcher and nailer, W. A. Case, Buffalo..... Dip.
Assortment of knitting, by Lamb's knitting machine, Jas. D. Orne, general agent, Rochester..... Trans.
Wagon jack, J. J. Bradner, Orange, Schuyler Co..... Trans.
Model of brick machine, David W. Seeley, Albany..... Dip.
Benedict's patent neck yoke, Benedict, Hamlin & Co., Albany..... Trans.
Axe helve, A. W. Marshall, Crittenden, N. Y..... Trans.
Trace buckle, W. R. Gray, Rochester..... Trans.
Model of machine for bolting shingle blocks, J. B. Hendy, Olean, N. Y... Trans.
New pocket guard, Isaac H. Clark, Boston, Mass..... Trans.
Model of milk rack and fruit dryer combined, C. B. Hart, Victor, N. Y... Trans.
Nail puller, J. P. Stevenson, Midway, Wooster Co., Mass..... Dip.
Baskets, Michael Solomon, Versailes, N. Y..... Dip.
Staveless barrel, Mayo's patent, M. M. Smith, Rochester..... Dip.
Draft attachment for harvesters, H. W. Pell, Rome, N. Y..... Dip.
Barlow's indigo blue, J. C. Potter, Alfred, N. Y..... Trans.
Wakeman's patent pole supporter, R. Backus, Amsterdam ..... Dip.
Patent ladder, W. A. Evans & Co., Buffalo..... Trans.
Patent meat cutter, R. Farr, West Chesterfield, N. Y..... Trans.
Animal trap, R. Farr, West Chesterfield, N. Y..... Dip.
Iron planes, G. & J. Telford & Co., Rochester..... Dip.
Model lever power, Nicholas Tripp, Niagara Falls..... Dip.
Patent mill stone pick, H. Park, Albion, Pa..... Trans.
Conical extension tread car wheel, E. Sampson, Troy..... Dip.
Case of files, Wolstenholm File Manuf. Co., Buffalo..... Dip.
American and foreign coins, T. J. Austin, North Buffalo..... Trans.
Fly nets, John Spettigue, Buffalo ..... Trans.
Wood saw, Moses J. Jones, Fredonia..... Trans.
Pair wagon pole springs, Henry Justise, Black Rock .... Dip.
Window sash frame, D. R. Gould, Chestertown, N. Y..... Trans.
Chart for cutting and fitting ladies' and children's dresses, Russell & Covert, New York..... Dip.

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Machine for quartering, coring and stringing apples, C. C. Richardson, Willink, Erie county, N. Y. ..... Trans.
Wire rat trap and wire vase, P. J. Kissel, Buffalo ..... Trans.
Rubber horse shoe cushions, S. C. A. Lottridge, Buffalo ..... Trans.
Improved hop line supporters, F. Frisbie, Rensselaerville, Albany Co. ..... Dip.
Model Harvester, B. G. H. Hathaway, Rockstream, Yates Co. ..... Dip.
Collection tubs and pails, manufactured at the Monroe county penitentiary, L. S. Fulton, superintendent, Rochester ..... Dip.
Hop pole puller, Wm. Smith, Nunda, Liv. Co., N. Y. ..... Dip.
Table slides, H. Olds, Syracuse ..... Dip.
Roller rounding iron, L. B. Gates, Barre Centre, Orleans county ..... Trans.
Merino fancy work basket, light burr-work frame, dark burr-work frame, cone miniature rocking chair, perforated bard cross, cone book mark, wreath of autumn leaves, Maria A. Ross, Newport ..... S. S. Med.

F. W. LAY,
J. E. ELY,
J. H. SELKREG, *Judges.*

CLASS VIII—HORTICULTURAL DEPARTMENT.

No. 40. CLASS 1—PROFESSIONAL LIST.

Cut Flowers.

For the best display, Henry Linke, Buffalo ..... S. S. Med.

Roses.

2d best variety, Henry Linke, Buffalo $3

Phloxes.

For the greatest number, Henry Linke, Buffalo 5

Verbenas.

For the greatest number and best varieties, W. J. Palmer, Buffalo 5
2d best, Henry Linke, Buffalo 3
Best 12 varieties, Henry Linke, Buffalo 3

German Asters.

2d best collection, Henry Linke, Buffalo 1

Pansies.

2d best collection, Henry Linke, Buffalo 1

There was a very creditable display of greenhouse plants, exhibited by Mr. Henry Linke, of Buffalo, as worthy of especial mention.

MRS. DR. LORD,
MRS. CHARLES GOLD,
MRS. S. F. MIXER, *Judges.*

No. 40. (A) CLASS 2—AMATEUR LIST.

Dahlias.

2d best 12 dissimilar blooms, Mrs. Mary M. Sorole, Hamburgh $1

Verbenas.

For the best seedling, not before exhibited, Mrs. Mary M. Sorole, Hamburgh 1

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Phloxes.

Best annual, John Tackle, Buffalo, gardener for M. P. Bush..... $2
Best 6 varieties of perennial phloxes, Mrs. Mary M. Sorole, Hamburgh.... 2

German Asters.

Best collection, Mrs. Mary M. Sorole, Hamburgh..... 3

Ten Week Stock.

Best display, John Tackle, Buffalo, gardener for M. P. Bush..... 3

MRS. CHARLES GOLD,
MRS. GEO. GOFF,
MRS. S. F. MIXER, *Judges.*

No. 40. (B) CLASS 3—GENERAL LIST.

Pot Plants.

Best collection of house plants, in pots, of 20 specimens, James Brown, Buffalo $10
Best 10 plants, in pots, James Brown, Buffalo..... 5
2d best, John Tackle, Buffalo, gardener for M. P. Bush..... 3

Floral Design or Ornament.

2d best, Henry Linke, Buffalo 3

Bouquets.

Best pair hand, W. J. Palmer, Buffalo..... 5
2d best, Henry Linke, Buffalo 3
2d best pair parlor, John Tackle, Buffalo..... 3

The cactus stock exhibited by Frederick Weimert and James Galloway, Buffalo, are worthy of special commendation.

MRS. S. F. MIXER,
MRS. CHARLES GOLD,
MRS. GEO. GOFF, *Judges*

No. 41. CLASS I—PROFESSIONAL LIST.

Apples.

Best 40 varieties, E. Ware Sylvester, Lyons, Wayne county..... $15
Best 20 varieties, E. Ware Sylvester..... 10
2d best, G. Zimmerman, Buffalo..... 5
Best 12 varieties, G. Zimmerman, Buffalo..... 6

Pears.

Best 20 varieties, Ellwanger & Barry, Rochester..... 15
2d best, E. Ware Sylvester, Lyons..... 10
Best 15 varieties, Ellwanger & Barry..... 10
2d best, E. Ware Sylvester, Lyons..... 5
Best 10 varieties, G. Zimmerman, Buffalo..... 8

No. 41. (A) PROFESSIONAL LIST.

Quinces.

Best dozen, Ellwanger & Barry, Rochester 3

Grapes.

52 varieties of natives, Ellwanger & Barry, Rochester..... 5
2d best, Pleasant Valley Grape Growers' Association, Hammondsport, Steuben county..... 3

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Best 1 variety, 6 bunches, "Delaware," Pleasant Valley Grape Growers' Association, Hammondsport, Steuben county $2
Best 1 variety, 3 bunches, "Catawba," Pleasant Valley Grape Growers' Association, Hammondsport 2
2d best, "Diana," Pleasant Valley Grape Growers' Association, Hammondsport 1

Discretionary.

Exhibition of native grapes, C. L. Hoag & Co., Lockport ..... Dip.

E. G. STUDLEY,
PETER V. KING,
ISAAC H. COCKS, *Judges.*

Inasmuch as the grape culture has become an important branch of horticulture, your committee would respectfully recommend that special premiums be awarded to the best three or six bunches of the leading kinds of grapes—the prejudices of individuals preventing a unanimous judgment as to which is preferable of the many varieties now on exhibition.

PETER V. KING,
ISAAC H. COCKS, *Judges.*

No. 41. (B) CLASS 2—AMATEUR LIST.

Apples.

Best 20 varieties, R. H. Brown, Greece $12
2d best, B. Baker, East Hamburgh 8
Best 15 varieties, W. Jackman, Youngstown 10
2d best, B. Baker, East Hamburgh 5
Best 10 varieties, R. H. Brown, Greece 5
2d best, B. Baker, East Hamburgh 3

Pears.

Best 15 varieties, H. G. Dickinson, Lyons 12
2d best, D. Ransom, Buffalo 8
Best 10 varieties, H. G. Dickinson, Lyons 10
Best 6 varieties, John H. Bell, West Brighton 8
2d best, H. A. Parsons, Niagara Falls 4

E. G. STUDLEY,
PETER V. KING,
ISAAC H. COCKS, *Judges*

No. 41. (C) AMATEUR LIST.

Plums.

Best 1 variety, E. Marvin, Buffalo $2

Quinces.

Best dozen, E. S. Hayward, Rochester 3
2d best, B. Baker, East Hamburgh 2

Grapes.

Best 1 variety, 6 bunches of native, John Wood, Bowmansville 2
Best 1 variety, 3 bunches foreign grapes, grown under glass, "Black Hamburgh," John Tackle, Buffalo 2
2d best, 2 bunches, Richard Bullymore, Buffalo 1

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Discretionary.

1 variety of citron, C. Van Deusen, Buffalo..... Trans.

E. G. STUDLEY,
P. V. KING,
ISAAC H. COCKS, *Judges.*

The Executive Committee would acknowledge their grateful thanks to all the contributors who aided in making this exhibition worthy of our State.

The weather was, upon the whole, satisfactory; and the throng which were present on Wednesday and Thursday indicated the deep interest which the people of Buffalo, and the counties adjoining, took in the exhibition.

The representative of one of the Chicago papers—*The Western Union*—gives a very interesting account of the entire exhibition. We give a few extracts from the same:

"The Twenty-seventh Annual Exhibition of the New York State Agricultural Society, held at Buffalo, October 1–4, was, in many respects, a highly successful one. The weather was, in the main, favorable, and the attendance very large—larger than usual. The receipts were about $22,000—making the fair, financially, a decided success. We suppose it impossible to manage such a fair to the satisfaction of all parties, so it is not surprising that complaints should be made as to this one. The buildings were very roughly constructed, and the grounds were not as suitable as could have been desired. The grounds selected were the best offered. We do not know who was responsible for these things, and take it for granted that the Society did the best possible under the circumstances.

"There are some features of the exhibitions of this Society that are worthy of consideration, and some of them of adoption by other societies. A noticeable feature is the absence of 'tests of speed,' either of running or trotting horses, hurdle races, 'female equestrianism,' and other popular features. All shows, swings, &c., are kept from the enclosure. The convenience of visitors is consulted in the arrangement of the ticket office, which is so built that three sides are open to the public, so that, if necessary, a dozen clerks can be employed in furnishing tickets. The plan of having an office for the General Superintendent, and for the superintendent of each department, is one that seems decidedly a good one. The stalls for cattle were built so as to give a full side view of the animals, the advantage of which arrangement will be appreciated by

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those who have attempted to carefully examine cattle in the ordinary narrow stalls. The pens for sheep and swine were arranged on the same plan.

"Visitors to most fairs have noticed the difficulty almost always found in getting an opportunity to examine the horses, unless more time be given than many persons can spare from other departments. It is not, of course, either safe or desirable to have horses 'handled' by a crowd—as this 'handling' would generally consist in 'making 'em stand round' by means of a smart cut with a whip or cane; but there should certainly be some provision by which the horses could be seen in their stalls.

"Representatives of the press were most courteously treated. A comfortable office, with all needed conveniences, was provided for their use, and the different daily papers made all the arrangements so satisfactory to the press who were present from abroad.

"The display of agricultural implements and machinery has probably never been surpassed in the United States. The show of reaping and mowing machines was particularly large and good. Almost every variety of farm machinery was represented, and there was a large number of recent improvements and inventions—some of them of much apparent value.

"Mechanics' Hall was well filled with an immense variety of articles, many of them designed especially for farmers. The same may be said of the building in which domestic manufactures and machinery were shown.

"The show of vegetables, grains, and of dairy products was not large, nor particularly good.

"Of flowers, but a very small display was made. Fruits were fairly represented, although the display was not what might be expected. Among the principal exhibitors were Ellwanger & Barry, Sylvester, Zimmerman, Dickerson, Moore, Crane, Hoag, McCulloch, &c. The display of grapes was the best in this department.

"The number of horses shown was smaller than is usual at exhibitions of this Society, nor, so far as we could learn, were they of superior character. In some classes the show was very meager. The young stock shown was generally better than the old. There were some very good mules on the ground.

"All the leading breeds of cattle were represented, and generally by good specimens; but, in point of numbers, the show fell short of our expectations. Hon. E. Cornell, of Ithaca, was the leading

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exhibitor of Short Horns, taking off a number of the principal premiums.

"The leading exhibitors of Ayrshires were Wolcott, Campbell & Co., and their cattle were remarkably fine. O. Howland, Auburn, and E. Harvey and J. F. Converse also showed Ayrshires.

"The display of Alderneys was unusually good, both in quantity and quality. W. B. Dinsmore, Staatsburgh, showed some twenty head. E. Corning, Jr., Albany, also showed some very good specimens.

"W. Cole, Batavia, showed twelve Devons of very good quality—dividing the premiums with Geo. Rudd, Geulph, Canada.

"E. Corning, Jr., and F. W. Stone were the principal exhibitors of Herefords. Some of the animals shown were the best we have seen of this breed.

"The show of sheep was really very good, and worthy of extended notice.

"The show of swine was large and good. Yorkshires, Cheshires, Suffolks, and Berkshires were represented in name at least. Most of the stock was from Jefferson county, N. Y. Messrs. Brodie, Huffstater, Cavanaugh, Converse and Dinsmore, were the leading exhibitors.

"Poultry was fairly represented."

Ex-President Fillmore was present, and other distinguished gentlemen, and delegates from the Agricultural Societies of Canada.

The immense labors of the clerks and assistants are appreciated by the Executive Board, and they return them their most cordial thanks for the manner in which their duties were discharged.

The discussions in the evening were very interesting. The address of Major H. T. Brooks, of Wyoming county, on apples and their culture in New York, was very ably enforced.

The discussion the second evening was on cutting and cooking food for cattle, and was opened by E. W. Stewart, of North Evans —giving the result of his experiments. He was followed by Lewis F. Allen, H. T. Brooks, George Geddes and G. A. Moore.

Following this discussion, Mr. Hawley, of Onondaga, opened the discussion on the manufacture of butter, and the kinds of salt used. The superiority of our own salt was established.

On the third evening, the eulogy on the late John A. King, Ex-President of the Society, by Ex-President Gould, was one of great interest.

To all who aided in giving success to this exhibition, the Executive Committee return their most cordial thanks.

B. P. JOHNSON, *Secretary.*

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REPORT

OF THE TWENTY-SEVENTH ANNUAL FAIR OF THE NEW YORK STATE AGRICULTURAL SOCIETY, HELD AT BUFFALO, OCTOBER 1, 2, 3, 4, 1867.

BY X. A. WILLARD, A. M., OF LITTLE FALLS, N. Y.

We take pleasure in recording the New York State Fair of 1867 to have been a grand success. The weather throughout was favorable, the attendance large, and the receipts more than an average with the best of previous exhibitions.

The show in agricultural implements and machinery has not, it is believed, been surpassed, in extent and variety, at any previous exhibition.

Nearly all the departments were well sustained. In some, the small display was fully made up by the excellence of the articles exhibited. But if particular classes were weak, it was not to be expected that all could be largely represented. There are various causes operating each year, which renders it extremely difficult to draw out exhibitors in certain departments. The reasons need not be discussed here; they obtain more or less at every fair.

There are few who appeciate properly the labors required in organizing and carrying forward an annual exhibition like that of the New York State Agricultural Society. Long experience, peculiar fitness, enthusiastic devotion on the part of officers and managers, have done much to make the New York State Fairs a national triumph. In saying this, we do not claim that these exhibitions are always unexceptionable, or are not susceptible of improvement. It is easy, sometimes, to see faults, and fancy they may be readily corrected; but to build up and carry forward an institution without faults, is of no easy attainment.

It is enough to say, that the New York State Fairs have always taken the lead and ranked pre-eminently first among similar exhibitions throughout the States; and the show of 1867, with all its faults, loses nothing in rank when measured by this standard.

THE GROUNDS AND BUILDINGS.

The location of the grounds was about three miles northeast of the city of Buffalo—a few minutes walk from Cold Spring, which is reached from the city by horse railroad.

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They comprised a level tract of land of some fifty acres, substantially fenced, and having a track for driving and display of horses. Here were erected the various buildings and tents required for the occasion. On the outer edge were arranged the stalls for horses and cattle, and the sheds for the poultry department. These were well built and commodious. Immediately in front of them was the track. Inside the track were placed the other departments of the fair, somewhat similar in arrangement to that of previous exhibitions. The grounds, unfortunately, presented a rough surface—appearing as if tread up by cattle in wet weather, and left to dry and harden in that condition.

The buildings were poor, unattractive in appearance, and, in some instances, of not sufficient capacity for the use for which intended. All, with but few exceptions, were much inferior to those usually erected for the State Fairs. The victualling department did not present its usual attractions.

These were the chief faults of the exhibition. They detracted from the visitors' full enjoyment of pleasure, and were the source of petulent comment from some. It is needless to go into detail as to the circumstances and causes of these faults. We simply record the facts in making up a true account of the exhibition.

Among the buildings erected by private enterprise, in which the display was more than ordinarily attractive, we give the following from one of the Buffalo papers:

PEASE HALL.

"The hall occupied by Mr. F. S. Pease, and built by himself, adjoins domestic hall, and is second to none on the grounds in point of attractiveness. It is fitted up with that good taste which distinguishes everything that Mr. Pease does; and the display of the various oils manufactured by him eclipses anything ever seen in this country. His exhibitions at the Paris Exposition, which secured to him a medal, and the second exhibition at the American Institute, may equal the one of which we write, but we can scarcely conceive how they can surpass it. He shows no fewer than sixty-three oils, together with his paints, &c., &c. The oils are the very finest, and are shown in bottles, or rather glass cylinders of various sizes, the larger ones resting on silver plated stands, and these in turn rising from black velvet covered pedestals.

"The Buffalo Steam Gauge Company exhibit their manufactures partly under Mr. Pease's roof and partly under the roof of domestic

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hall. They display two superb locomotive head lights, with newest style of cases and burners; a variety of steam gauges, patents of the company, in various sizes, and in iron, brass and silver plated cases; two pyrometers, the first manufactured in this country, and intended to register the temperature of the hot blast in the blast furnace; two fancy silver plated hand lanterns; engine lamps, square lamps; signals showing three different lights, for railroad trains, and a locomotive torch. The company's manufactures received abundant compliment from visitors.

PRATT AND COMPANY'S HALL.

"This hall, constructed by Messrs. Pratt & Co., is fifty by thirty, and sports the stars and stripes, and a large sign over the door. A small steam engine propels two nail machines, which prove to be objects of great curiosity. The first of these—the horse nail machine, invented by A. H. Carroll, of Forge River, Mass.—solves a problem in mechanics which has heretofore been considered insoluble, *i. e.*, whether a horse-shoe nail could possibly be made by machinery. One operator heats the irons and feeds the machine, and the latter, which has a sort of mechanical humanity, throws off, with great rapidity, perfect nails. The iron is hammered far more effectively than that by hand, and the nail is as pliable as need be when finished. There are twelve of these now in operation in Pratt & Co.'s Nail Works, capable of turning out six hundred pounds of horse-shoe nails per day.

"The cut-nail machine has three motions, those of the cutting lever, the griping lever and the heading."

In noticing the several departments, we may not follow the above order strictly, but shall rather take that in from which our notes were made up. We commence with

CLASS I.—CATTLE.

SHORT HORNS.

The display of cattle, though not so large as at some previous exhibitions, was, in point of quality, quite meritorious. In Short Horns, Hon. E. Cornell, of Ithaca, was the leading exhibitor—showing some specimens of this breed of remarkable excellence. He exhibited fourteen animals, and among them a cow weighing 1,015 pounds—a fine specimen of this breed of cattle. One two year old heifer, a yearling, and two calves, are of great promise, and will fully sustain the high reputation which this herd has acquired. John D. Wing showed three, and E. Harvey, of Buffalo, four. J. &

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S. Kinsey, of Darien, had five head, among which was a yearling bull, which attracted some attention. Hon. A. B. Conger, of Rockland, had nine Short Horns upon the ground, three bulls and four cows, which Mr. C. claimed to have been bred with particular reference for milking stock. Mr. H. D. Knapp, of West Hamburgh, showed a two year old bull, pure white, and Mr. E. Stone, of Guelph, C. W., a very good bull. Messrs. Walcott and Campbell, of York Mills, had one representative in this class—a heifer calf of great excellence.

The *Country Gentleman*, in noticing this breed, remarks as follows: "The cattle present included but a small entry of Short Horns. Those exhibited by Hon. E. Cornell, Ithaca—we believe six cows and a bull—are entitled to leading mention. They were in very extra condition, if not a little beyond the dictates of the soundest judgment, but showed very successful management in getting good growth, and had evidently been in charge of a most capable herdsman. The yearling heifer and red and white heifer calf were extraordinarily good, and very beautiful animals. The bull was a two year old, dark red, sired, we believe, by Mr. Cornell's prize bull at Saratoga, a year ago. Hon. A. B. Conger, Haverstraw, exhibited several aged bulls and a number of females, which were quite as much in the extreme of low keeping as the former were in the contrary direction, and to such an extent that their really excellent points were likely to have been overlooked, except by very close and able judges. F. W. Stone, Esq., Guelph, C. W., showed a very fine three-year old bull, red, of excellent size for his age, and particularly good in the fore-quarters. It was hoped that there would have been other exhibitors from Canada in this class. A heifer calf of great excellence was shown by Walcott and Campbell, New York Mills, just in good field condition—especially good in crops and shoulder. There were several head from an exhibitor whose name is not on our notes, of fair degree of merit, but thrown out for lack of pedigrees properly authenticated, though probably correct, if the records to prove them so could have been procured. Another exhibitor showed a bull, and still a third was present with several head, which failed to meet the necessary rules of the Society in this respect—to the great disappointment of their owners, and illustrating the importance to purchasers of stock, purporting to be pure-blooded, of obtaining with their purchases the documents essential in completely establishing the claim. There were some Short Horns

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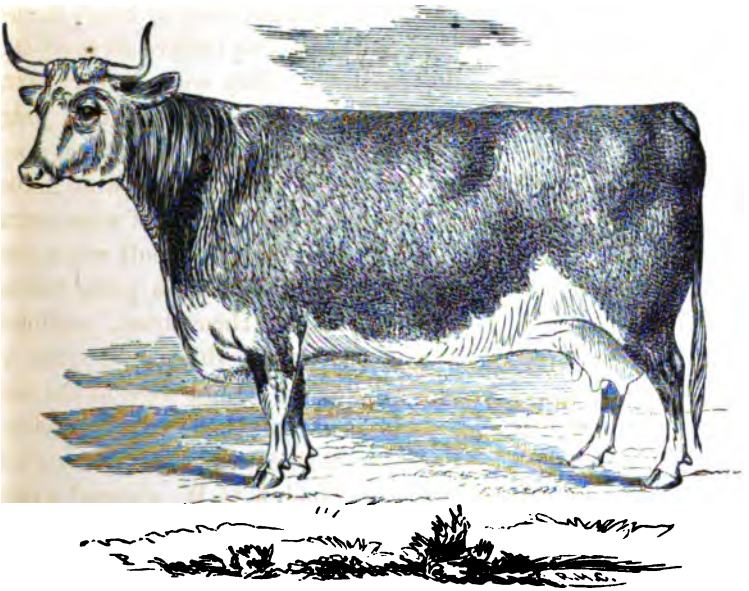

HEREFORD COW—MARCHIONESS.

Winner of the First Prize at the Buffalo Fair of the New York State Agricultural Society, 1867. The property of E. Corning, Jr., Albany, N. Y.

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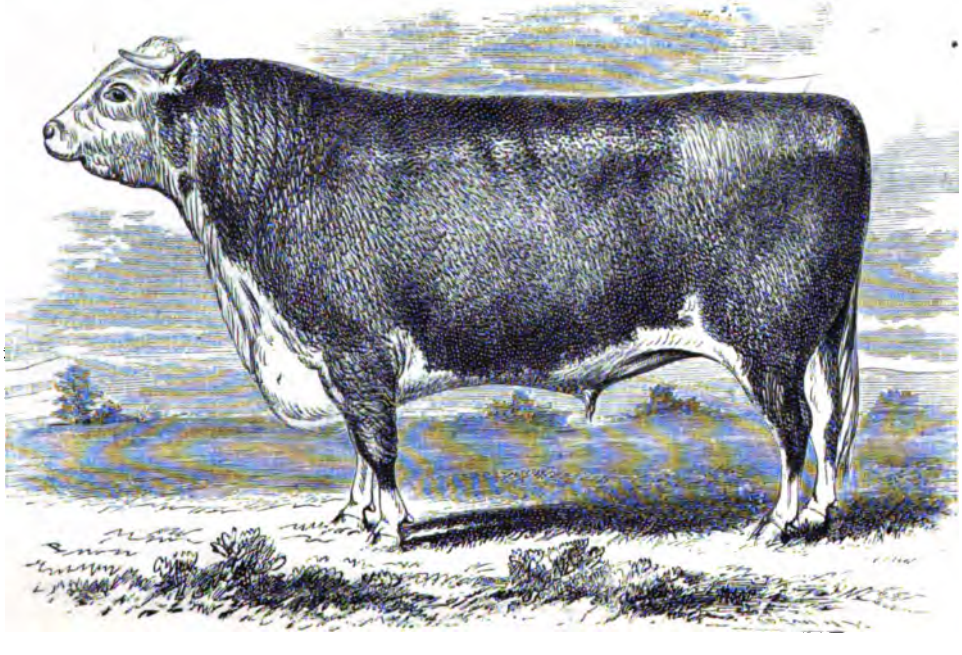

HEREFORD BULL—EMPEROR.

2 years old. Bred by Frederick Wm. Stone, Moreton Lodge, Guelph, Ontario, Canada.

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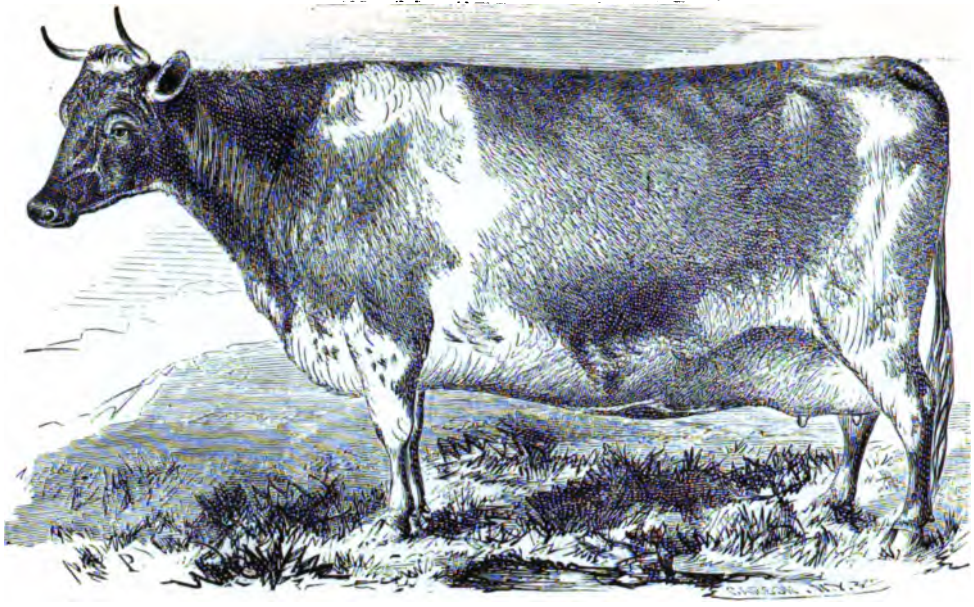

AYRSHIRE COW—MAUD.

WINNER OF SECOND PRIZE at the New York State Fair, Buffalo, 1867. Bred by CAMPBELL & BRODIE. The property of WALCOTT & CAMPBELL, New York Mills. Sire—Rob Roy; Dam—Mayflower,

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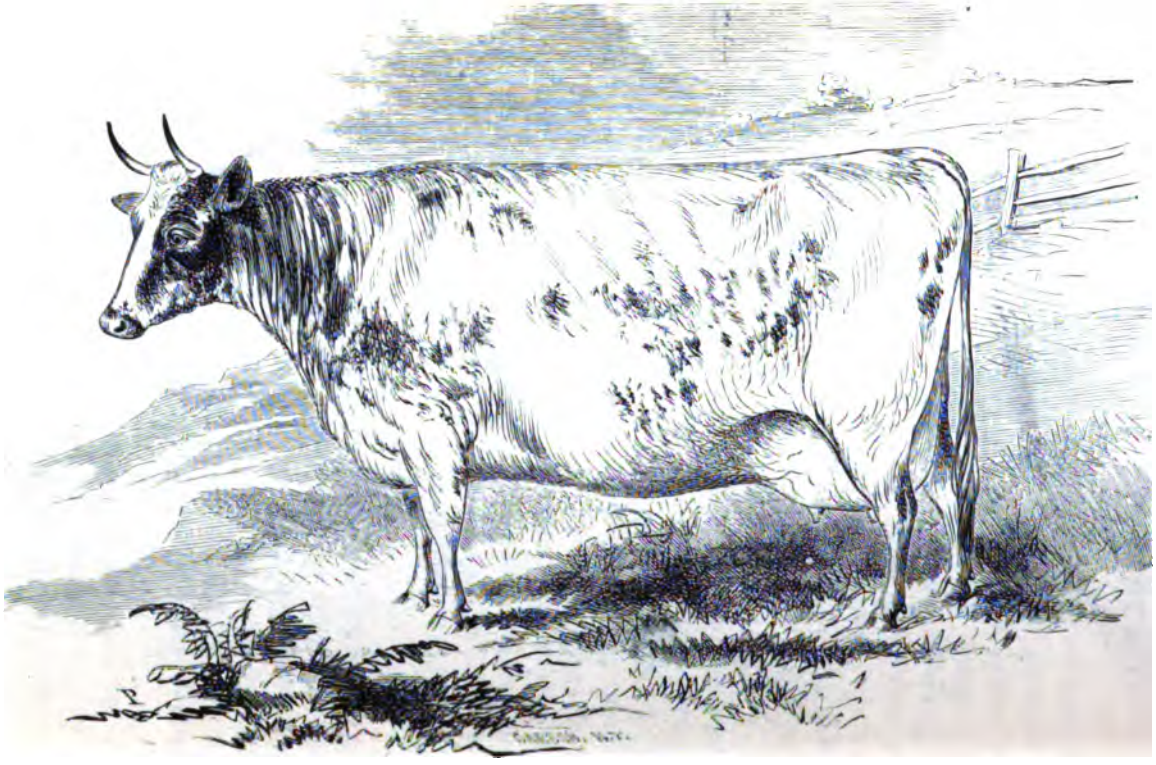

AYRSHIRE COW—DAISY.

WINNER OF THE FIRST PRIZE, at the New York State Fair, at Buffalo, 1867. Bred by CAMPBELL & BRODIE. The property of WALCOTT & CAMPBELL, New York Mills, N. Y. Got by "Billy;" dam "Dairymaid."

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in the stalls, but the foregoing comprises, we believe, those specially worthy of remark.

DEVONS.

Walter Cole, of Batavia, exhibited, some fine specimens of this breed. A part of the animals shown took premiums at the Michigan State Fair. His exhibition comprised a four-year old and one yearling bull, six cows and some calves. The older bull was much admired.

Mr. George Rudd, of Guelph, C. W., also was an exhibitor of several head. A very fine pair of grade Devon working oxen four years old was shown by C. Diven, Monroe county, N. Y. Their weight was about four thousand pounds. The admirers of Devon cattle were generally disappointed in not seeing a larger representation of this useful breed upon the grounds.

HEREFORDS.

In this class Mr. Corning, of Albany, was the leading exhibitor having seven head from his well known herd upon the grounds. They are beautiful specimens of this type of cattle, which some esteem as unequaled for making beef. Mr. F. W. Stone, of Canada, was also an exhibitor in this class. The stock shown by Mr. Stone was of recent importation, in excellent condition, and showed the breed to the best advantage. Of the five females on exhibition, all but one had been prizetakers in Canada. His show was an extraordinary good one, and attracted considerable attention.

AYRSHIRES.

If there was not a large number of Ayrshires on the ground, the admirers of this breed had the pleasure of seeing some of the best animals in the country. We refer to the stock in this class from the splendid herd of Messrs. Walcott and Campbell, of New York Mills. The animals upon the grounds were the seven-year old cow "Daisy," "Maud," a four-year old, "Helen Mar" and "Bloom," two-year old heifers, and "Jessie" and "Ella," yearlings.

The splendid imported bull "Tarbolton," which took the first prize at Saratoga, in 1866, was also entered as a competitor for the herd medal.

O. Howland, of Auburn, exhibited "Governor 5th," a three-year old, one two-year old, a yearling and two heifer calves.

Mr. J. F. Converse, of Jefferson county, a yearling bull; and Mr. E. Harvey, of Buffalo, the bull John McGregor."

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ALDERNEYS.

One of the largest and best displays of this breed ever had at the State Fair, was shown this year. The leading exhibitor was W. B. Dinsmore, of Staatsburgh, who alone made twenty-one entries, several of the number being imported. This large and excellent display of Mr. Dinsmore attracted universal attention.

E. Corning, Jr., of Albany, was also an exhibitor in this class, showing seven. Among which, the imported cows "Violet" and "Lady Eva," and the four-year old bull "Romeo," were particularly noticeable.

GALLOWAYS.

Of this breed we noticed but one specimen on the grounds—a four-year old bull, bred in Canada, and exhibited by Levi Gillett, of Youngstown.

FAT CATTLE.

The fat cattle shown did credit to Mr. J. W. Taylor, of East Bloomfield, Ontario county, who had a half dozen or more on the grounds. One of them, a steer, weighing 2,500 pounds; a white Kentucky cow, though falling short of this weight, exceeded the steer, if possible, in point of condition. Mr. Thomas Hoseberry also showed a splendid Short Horn cow in admirable condition. A pair of working oxen was shown by H. Ames, of Livingston county, N. Y.

CLASS II.—HORSES.

There was less interest manifested this year in the display of horses than usual. There were a few good animals on the grounds, but the show, as a whole, was hardly up to that of previous exhibitions. The following, from the *Country Gentleman*, gives a fair estimate of this department:

"The show of horses was small in point of number, especially in the class of harness horses—few owners of fine carriage or driving horses apparently being willing to take the trouble to exhibit, and of saddle horses there were none. In point of merit, the harness horses were up to the average only, but the young stock presented a display of general merit and contained some very fine specimens. Exceptions to the general mediocrity of the harness horses were a pair of bay carriage horses, four or five years old, showed by Mr. Parsons, of Auburn; a pair of roadsters, by Mr. Jerauld, of Niagara Falls, and a single trotting gelding by Mr. Conger, of Rockland—these taking the first prizes in their classes, and being worthy of better competitors than, with few exceptions, appeared against

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them. Mr. Robert Bell, of West Brighton, showed three brown fillies, sisters, three and two years and one year old, evidently very well bred and very beautiful, for which he took three first prizes. In fact, the young stock was far ahead of the old, which would tend to show that most of the exhibition in this class was made by the breeders. Some very diminutive Shetland ponies, excellant specimens of their kind, were exhibited by Mrs. Lord, Buffalo, attracting great attention from young and old.

"The entry of mules was larger than usual, but very few appeared before the judges—among them one remarkable fine pair of two-year olds, large, well broken, and of good action, shown by M. V. Kibby, Kankakee City, Ill."

CLASS III.—SHEEP.

SILESIAN MERINOS AND NEGRETTIS.

The show in sheep was large and excellent. In fine wools, Mr. Chamberlain, of Red Hook, had a large exhibition from his well-known flock of Silesian merinos, including several Negrettis, of recent importation. The number of thorough-breds and grades from this flock upon the grounds was fifty-four. Mr. Chamberlain's sheep are so well known to the public that it is needless for us here to speak of their peculiar excellencies. We may remark, however, that the imported rams and ewes are strongly marked with wrinkles and corrugations about the neck and tails, now so fashionable among breeders of this stock, both at home and abroad.

The show of fine wools from Vermont was quite large. B. F. Van Vleet, Bright and Parmelee, had four pens containing fifteen sheep, some of them of great excellence; H. C. Burwell, of Bridport, showed a three year old ram, having a fine, compact fleece. His clip this year weighs twenty pounds and two ounces, and gave six and three-quarters pounds of cleansed wool. J. E. Parker, of of Whiting, Addison county, Vt., had two pens from the Stickney and Hammond stock. The ram Young Addison, a yearling, is very large and fine, with a good leg, and is well wooled. The rams Gold Drop, 2d, and Gen. Fremont, are more than ordinarily fine, and show judicious breeding. A. Baldwin, of Addison county, Vt., showed fifteen sheep that were good specimens of the Robinson and Hammond stock. Mr. Baldwin's flock averaged nine pounds of wool each to the clip. E. Townsend, of Pavilion, N. Y., had a good display, twenty-seven sheep in all. J. A. Thompson, of Newstead, Erie county, showed a pen of nice Merino lambs. J. B.

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Lusk, of Batavia, N. Y., showed two pens of ewe lambs, bred from Hammond stock. G. C. Cook, of Medina, N. Y., had two pens of yearlings, very fine, and also of Hammond stock. E. P. Jarvis showed some good specimens of French merinos. R. E. Keese, of Middlebury, Vt., had a good show of the Atwood stock of Merinos, some of them bred by Munger. In one of the pens was Munger's stock buck, an animal of much merit.

SOUTHDOWNS.

In Southdowns, Geo. H. Brown, of Dutchess county, had eight pens, an excellent exhibition, and hard to be beat. L. L. Lorillard, of West Farms, Westchester county, had nine pens; among the rams, one was very large and fine. A. McArthur, of Erie county, and F. W. Stone, of Canada West, were also exhibitors of this breed.

COTSWOLDS, LEICESTERS, AND LINCOLNS.

The Cotswolds were upon the ground in considerable force, John D. Wing, of Washington, Dutchess county, had ten ewes; and the ram "Golden Fleece," which has taken several premiums. It is a very handsome animal, and attracted much attention. Isaac Akin, of Dutchess county, is also an exhibitor in this class. The show of long wools from Canada was large and exceedingly fine. Among the exhibitors was Mr. F. W. Stone, of Canada West; John Gill, of Grahamville, C. W., who had four pens; Donald Robinson, Queenstown Heights, C. W., five pens of Leicesters, very fine; John Snell, Canada West, six pens, twelve Cotswolds and one Leicester ram weighing three hundred and forty pounds, and but one year old. Walcott & Campbell, New York Mills, had a splendid exhibition of Leicesters and Lincolns—the latter consisting of a part of his imported stock, which, in point of merit, is not surpassed by any flock of Lincolns in this country. These sheep attracted much attention, and no farmer who looked upon this splendid exhibition of long wools but must have been impressed with the advantages which this character of sheep possess, in many respects, over the fine wools. There were more good specimens of cross-bred sheep for mutton—C. West exhibiting eight pens, and A. McArthur three pens.

GOATS.

Mr. Dinsmore made a fine show of Angora goats, with samples of fleece in various colors. These attracted universal attention. E. B. & C. R. Durkee, of Alden, Erie county, showed three pair of goats of different varieties.

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SWINE.

We have never seen a larger or better show of swine at the State Fair. This department attracted much attention, and was universally commended. The principal exhibitors are from Jefferson county, and we believe nothing better in the large breed can be found anywhere in this country than was shown by Jefferson county exhibitors. S. P. Huffstater, of Watertown, displayed thirty-nine Yorkshires, and five March pigs, clean, fat and of great excellence. Mr. A. C. Clark, of Henderson, Jefferson county, had some fourteen pens of improved Cheshires, a breed well known as exceedingly handsome, and of early ripening variety; his March pigs average three hundred pounds each. Mr. James Brodie, of Jefferson county, had a fine display of Yorkshires, a part of them imported, and the balance bred from this stock. T. T. Cavanagh, of Watertown, exhibited thirty-five splendid Cheshires. William Dinsmore, of Staatsburgh, Dutchess county, had eight pens of Prince Albert Suffolks, a very popular breed of the small variety.

They were the only thoroughbred pigs of the small breed class on the ground. Some of them imported, and all from imported stock. Among Mr. Brodie's display of Yorkshires, we might notice a fourteen months old boar, in light condition, weighing 500 pounds; and another of a finer stamp, very thin haired and skinned, with great length of barrel, which weighed 475 pounds at eleven months. Two sows of the smaller class, fine made but heavy, averaged 400 pounds.

POULTRY.

The show of poultry was not as large as has previously been had at some of our State fairs, but the exhibition was very creditable, and many of the birds of great excellence. Lewis F. Allen, of Black Rock, was one of the largest exhibitors, showing three coops of golden seabright bantams; two coops gray dorkings; two coops brown China geese; two coops white China geese; two coops mottled China geese, and two of gray China geese. The different varieties of geese, shown by Mr. Allen, we have rarely seen surpassed in beauty and excellence. B. H. Nichols, of Lockport, N. Y., had a pair of bronze turkeys, which were much admired; the male bird is an immense fellow, and promises to rival his father on the scales—his weight being forty-six pounds, a very substantial Christmas dinner for a small family. Mr. Nichols exhibited a pair of Derby game fowls, a pair of duck wing fowls from imported stock, a pair of golden spangled chittegongs, a pair of young Sicil-

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lians, a trio of Bolton grays, a pair of Bramas pea-combed fowls; also, a single comb of the same, a trio of black Spanish, a trio of French La Fleche, one pair of rose-combed Leghorns, and the same number of single-combed Leghorns. Mr. Nichols' exhibition was a large and an exceedingly fine one—the birds showing health, size and good breeding.

L. L. Lorrillard, of Westchester, exhibited two coops of dorkings, very fine; Joseph Franklin, one coop of game fowls; Robert Bell, a lot of frizzle fowls—queer looking birds, and some excellent specimens of black Cayuga, and white top-knot ducks. Dickman Mench, of Buffalo, was the only large exhibitor of pigeons. His collection embraced several varieties, among which were the white fan-tails, the black stripe, yellow, black and white ruffle-necks, red and white pouters, and gray top-knots, from Germany. A pair of swan geese was shown by Peter Wannemaker. Thomas Gould, of Aurora, Cayuga county, had a very fine exhibition of lop-eared rabbits.

CLASS IV.—VEGETABLES AND THE DAIRY.

VEGETABLE AND DAIRY HALL.

An accident occurring the first day of the fair to Vegetable Hall, this class of articles was removed and shown in Dairy Hall. It was a large circular tent, and quite a variety of articles were exhibited here besides those pertaining to the dairy.

THE VEGETABLES.

The display of vegetables was hardly an average one, and the exhibitors few in number for the State fair. We give the names of the most prominent exhibitors:

George Cooper, of Rochester, made a very creditable display, and took several premiums.

James Haldane, of Buffalo, had a large and excellent show of different varieties of vegetables. Among which his celery and Hubbard squashes were noticeable. He also took several premiums.

W. H. Davis, of Springbrook, made a fair show of vegetables, particularly in Hubbard squashes.

Enoch Thomas made an excellent show of potatoes, and carried off the first premium for the early Goodrich variety. His Copper Russetts were also fine.

James Franklin had a very good show of tomatoes, of which the Keyes' Prolific varieties were very nice.

John Tackel, gardener to Mr. Bush, of Buffalo, made a fine display

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of different kinds of vegetables, showing some superb specimens of egg plant.

Mr. R. Frazier, of Cold Spring, exhibited some nice carrots.

Mr. W. C. Allen, of Black Rock, had a good show of vegetables, and a very excellent sample of Lima beans.

BUTTER.

The exhibition of butter was large and excellent. We never remember to have seen so fine a display at the State Fair. The southern tier of counties—the great butter region of the State—were well represented. What characterized the exhibition of butter was its fine quality. It was a great contest among noted butter-makers, every one of whom had a name in the markets. This gave the show in this department more than ordinary interest. To some of our dairymen who have been in the habit of putting up "grease" under the name of butter, and wondering why their product sells so low in the market, these beautiful parcels, nicely put up in oaken tubs, must have conveyed an instructive lesson. We cannot give the names of all the exhibitors, or go into detail further on the merits of this exhibition, but must refer the reader to the excellent report of the butter committee—merely giving the following among the successful competitors: J. S. Holbert, of Chemung, was awarded the first premium for fifty pounds made in June; Amos Goulding, Le Ray, N. Y., got the second; A. P. Bowman, of Bradford county, Pa., had the third. John Shattuck, of Chenango, carried off the first premium for the best twenty-five pounds made in June; J. S. Holbert the second, and E. Rose, Delaware, the third.

CHEESE.

There has always been considerable difficulty in getting out a good show of cheese at the State Fair. It is to be regretted that our cheese dairymen are so backward in bringing together from the various cheese producing counties specimens of this branch of dairy manufacture. We believe an annual cheese show would do much to improve the manufacture of cheese throughout the State. It is only by comparison that we are able to fully appreciate the quality and texture of "our own goods." There is no better way of testing and comparing cheese than at a show where a great number of samples are together. In Scotland they have annual cheese shows, which are largely represented from all the cheese districts of the country. They have been of important service in improving the character of Scotch cheese. We need something of the kind in this

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country, and it should be in connection with our State fairs. We have never had but two good exhibitions of cheese in the State That of 1865, at Utica, was the largest, and was one of the leading features of the State Fair. Improved manufacture followed from it.

We suggest that the cheese dairymen come out in force again. Let the exhibition be at the State Fair of 1868.

For so great an interest as is the cheese dairying of New York, the cheese exhibition at the Fair this year was a disgrace. Had it not been for four or five exhibitors, it would have been an entire failure. They did well in coming out, and in not letting this department go by default.

New York State has an export trade in cheese to the amount annually of from seven to ten millions of dollars. Those who represented this great interest at the State Fair for 1867, we think deserve to be named, and we make the record.

F. W. Collins, of Otsego, got the first award on American Chedder cheese. H. & A. Akerly, of Rushford, Allegany county, had the first premium for factory cheese. J. & S. Kinsey and Henry Atwood take second and third, respectively. O. C. Crocker, of Binghamton, had the first on farm dairy cheese.

We think there may have been two or three more samples shown, but we cannot now call to mind the exhibitors' names.

DAIRY APPARATUS.

In dairy apparatus O. O'Neil & Co., Utica, and Ralph & Co., of Utica, made a fine display of their popular cheese vats, hoops, &c., &c. Ralph & Co.'s dairy pail and cheese sink attracted much attention; they were of recent invention and valuable.

The dairy pail deserves more than a passing notice. It is a wooden pail lined with tin, the tin removable at pleasure, and of such a form that no refuse matter is liable to accumulate in the corners. It is easily cleansed, and the wooden pail serves as a protection of the tin, making the whole substantial and durable. This pail should be generally introduced in the dairy. The first premium was awarded Messrs. Ralph & Co. for their well-known cheese vat and heater, which has recently been greatly improved by introducing the equalizer or heat distributer—a very simple, yet extremely valuable improvement.

O. O'Neil & Co. took the second premium on cheese vats—a very serviceable and useful vat for dairymen and factories. Both the above vats are so well known to the public, that it is unnecessary to give a description of their construction.

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H. & E. F. Cooper, Watertown, N. Y., showed their factory vats with Maple's improvement, which consisted of a cast-iron tank in the bottom of the vat, with copper distributing pipes so arranged than when the steam is let into the tank, there is an equal circulation of heat throughout every part of the vat. Mr. Cooper told us that on a test with six thermometers in different parts of the vat, on raising the water to ninety degrees, there was no variation in temperature. A tubular portable boiler is used in connection with these vats, and the whole makes a valuable improvement.

The big Canada cheese made at the Ingersoll factory, C. W., and weighing 7,000 pounds, was shown outside the grounds, and should have been one of the features of the fair.

SALT.

A notable exhibition in Dairy Hall was the large number of samples of salt shown by the Onondaga Salt Company of Syracuse. It was the largest and best exhibition of the kind we ever remember to have seen at the fair. It was a splendid display, embracing five kinds of salt—for butter, for cheese, fish packing, and pork and beef packing. We believe there is now no better salt made in the world than that of the Onondaga Salt Works. The Goderich (Canada West) Salt Company exhibited a very nice sample of salt, which is said to be of very pure quality.

GRAIN AND SEEDS.

These were shown in dairy hall, but were extremely meagre in quantity. We noticed some fine samples of wheat, barley and oats from W. P. Ottley, of Phelps, Ontario county. O. Howland, of Auburn, exhibited wheat, barley and grass seed. E. A. Horton, sample of wheat. There were several fine specimens of corn, but we can only note the following, which took premiums:

R. L. Howard had the first on yellow seed corn. O. Howland had the first on white flint corn. W. P. Ottley, Phelps, for the best sample of Indian corn—one barrel.

Of the other articles in this department taking premiums, we note the following:

Amos Goulding, of Le Ray, had the first on maple sugar.

William Harris took the first on twenty pounds of honey.

William J. Smith had the first on specimens of canned fruit.

Oven & Tracey, Buffalo, had the first premium on wheat bread.

Charles M. Platt had the first award on the best barrel of flour.

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W. Wright, of Hamlin, Monroe county, had nineteen bottles of preserved fruit, and took the second prize.

F. Frisbie, of Rensselaerville, showed here a model of Bushe's improved hop trailer. It consisted of a short pole, with a cast iron socket in the top for inserting four branches, upon which the vines are to be trimmed.

B. N. Comings, of New Britain, Conn., had a very compact and convenient berry crate, manufactured by the American Basket Company. A good thing.

BEE HIVES.

Among the bee hives exhibited in this department, we noticed one of novel construction, and which appeared to be a valuable improvement. It was a double hive, consisting of movable frames in the centre, held together by an iron bail and key. Upon this the honey boxes are arranged, and the whole inclosed by a box, movable at pleasure. In winter cut straw may be packed between the frames and outer box, three and a quarter inches in thickness, and the bees wintered in safety. J. M. Beebe, of Cassadaga, N. Y., is the inventor and exhibitor. He also exhibited an arrangement for feeding bees, an excellent device, and indorsed by some of our best bee keepers.

We commend Mr. Beebe's hive and feeder to the attention of bee keepers as simple in construction, and supplying what has long been wanted by the aparian.

In vegetable hall, so named, J. D. Dudley had suspended his massive diving armor, which attracted much attention.

After the vegetables, &c., were removed to dairy hall, the building was used for articles coming under the head of the domestic and other classes, to which we shall refer hereafter.

DOMESTIC HALL.

Domestic hall was a spacious building, filled with a vast number of articles. A description of these, even though brief, would fill many pages of this report. We shall not attempt to give anything like a full account of the splendid display in this department. A considerable portion of the building was occupied by Buffalo exhibitors. In addition to our own notes, we add those given in the reports of the *Buffalo Express*, the *Courier*, and the *Commercial Advertiser*.

"F. S. Pease had secured an advantage over all other exhibitors in the prominent exhibition of his display at the entrance of the building. He had improved his advantage to the utmost, and the

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exquisite taste and costly elegance with which he had prepared and arranged his extensive representation of oils and incident articles was a study.

"Near the entrance, Messrs. Bryant & Stratton, of the Buffalo Business College, covered a broad space of the walls with an exhibition of penmanship which can be called nothing less than magnificent. It was beyond question the most artistic and the most imposing in its scale that ever was shown at a State Fair. The center piece of the collection was a wonderful pen picture by Prof. C. B. Knowlton, representing 'The Fight for the Flag' in the Valley of the Shenandoah, occupying a frame four and a half by six feet in dimensions. This was surrounded by eight other large and superb frames, filled with elegant specimens of penmanship, in various styles.

"If anything more deserving than this to be classed among the fine arts was exhibited in the hall, it was an extraordinary copy of Da Vinci's 'Last Supper' in embroidery, the work of Mrs. John Wilcox, of Rochester.

"Messrs. Pratt & Letchworth, made a notably elegant exhibition of samples of the innumerable articles in saddlery and hardware which they manufacture at their two establishments—the Penitentiary shop and the Malleable Iron Works at Black Rock. The large show case in which their display was made attracted much attention, and nothing more creditable to Buffalo skill in the finer departments of manufacture could be seen on the grounds.

"The Buffalo Dental Manufacturing Company, one of the young enterprises of the city, made a very creditable exhibition of their work. They are manufacturing a number of exceedingly ingenious Buffalo inventions, including Snow & Lewis' automatic plugger, and the vulcanizers of Dr. Hayes and Dr. Whitney.

"In the musical line a large and fine display of instruments was made, especially of melodeons and organs, by Messrs. Geo. A Prince & Co., and Derrick, Felgemacher & Co., and pianos by the Central Piano Forte Co., of New York, whose instruments deserved the careful attention of visitors.

The *Courier* gave the following account of Buffalo exhibitors in Domestic Hall:

"Jewett, Church & Co., made a handsome display of silver and silver-plated ware and house furnishing goods in great variety; and Mr. John C. Jewett exhibited the self-ventilating Palace Refrigerator, a valuable invention, and a large assortment of toilet ware,

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bird cages, water coolers, bathing apparatus, and other things rendered popular long ago.

"L. A. Sirret exhibited a case of gray mink, Russian sable, and silver gray fox furs, which attracted considerable attention from the ladies.

"Strong and McNeal were nicely represented by their soap-stone stoves, marble and marbleized mantles, furnaces, and marble articles too numerous to mention.

"M. Strauss had a fine display of sheep-skin morocco; and Volger, Riebeling & Co. had on exhibition something handsome in the line of willow ware, and a bookcase with willow ornamentation.

"P. Smith exhibited his telescopic rifle, a superb piece of workmanship, two double fowling pieces, and one single fowling piece, of improved manufacture. The first named should have found a place in the Paris Exposition. J. C. Barnes & Co. showed something neat in curtain hangings, and something suggestive of comfort in their spring bed. Henry Childs was substantially represented by car and locomotive axles from the Buffalo Steam Forge; Irlbacker & Davis have shown what they are capable of in the gas-fitting and plumbing line; the gas fixtures look well. Campbell & Washburn exhibited a Telurian, a beautiful astronomical instrument. Storms & Furman contributed a case of boys' clothing, which was decidedly handsome. Cuttier & Denton showed a beautiful case of their finest musical instruments. W. Wacker showed a billiard table; and the well-known designer, F. Leard, was out in some illuminated bulletin letters and crayon sketches, which showed artistic taste. There is not much worthy of note in the line of fine arts, although there are a few things which we cannot overlook. Mrs. John Wilcox, of Rochester, exhibited an embroidered representation of the Lord's Supper, which takes rank with the very finest things of the kind we have ever seen at our State Fairs.

"R. W. Lester, of Fredonia, exhibited bust likenesses, and pencil drawings in imitation of marbles, which are really exquisite. The artist was then but eighteen years of age, and most of the specimens on exhibition were drawn at one time or another during a seven years' illness. The meritorious character of the designs, and the weakness of the artist, induce us to commend the sketches to the attention of visitors who may be disposed to enrich their libraries or drawing-rooms.

"P. J. Hamour exhibited a globe composed of tin foil, such as encases the chewing-weed. It weighed 41½ pounds, and 2,092 full-

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sized sheets were used in its construction. It was in a glass case, and was an attraction. Mrs. M. L. Ritt displayed a white knit bed spread of shell pattern. It was an elaborate piece of handiwork and must have cost some time and patience. Mrs. John Henly, who lives at 132 Perry street, is known in the hall as the Limerick lace worker, inasmuch as she showed the process of lace making. She exhibited some pretty specimens of her work.

"Dingens Brothers made a liberal display of their liquors, wines and syrups, but it was late when they had completed their arrangements, and we cannot speak specifically of their exhibition. The Buffalo Fancy Wire Works showed some decidedly fanciful designs in wire; and Clark, Ruger & Co. have several novelties in the way of sash supporters, window locks, and blind openers. There were numerous pianos and organs on exhibition, but we shall refer to them at another time.

"Sweet & Harvey made a good show of children's carriages—a new branch of manufacture in Buffalo. Bailey & Gillett exhibited an inexhaustive variety of files. D. Sikes exhibited his national dish-washing machine, which is a house-keeping desideratum that should command attention for it. Lantz Brothers & Co. advertised, in a legitimate way, their French toilet and washing soap. Gesselgen, Heinz & Co. showed their self-ventilating refrigerator. Montgomery Brothers had facilities for demonstrating the value of their 'elastic sponge,' and the elegance of their paper hangings.

"Leaving for a time the displays of Buffalo exhibitors, we cannot escape from the hall without consulting the town clock, manufactured by one of our ingenious German citizens, Matthias Dentz. Nor would we escape, if we could, without devoting a short time to the stained glass memorial window, painted by Mr. W. H. Meyers, for Christ's Church, Manlius, N. Y.—a magnificent design, magnificently executed.

"The Morse Eraser Company, of Philadelphia, through their agent E. B. Wentworth, of Syracuse, showed very useful little articles for the office and counting room, in the shape of pen-holders and erasers combined, &c.

"George R. McIntyre, Niagara Falls, had a useful article in the shape of a cloth roller and measurer. Volger, Riebeling & Co., Buffalo, exhibited a nice assortment of willow baskets, &c. Stewart Elder, Buffalo, displayed beds and bedding, and a beautiful pattern of paper hanging. J. A. Danbridge, Buffalo, showed a raised ornamental bulletin board for advertising purposes. George W. Mar-

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shall & Co., Waterloo, showed some handsomely finished melodeons. J. Esty, of Brattleboro, Vt., showed his well-known melodeon. C. Kurzman, Buffalo, showed a magnificently made piano. The Buffalo Yeast Company have any quantity of their articles on hand. J. C. Van Duzer, New York, showed the handsome Empire Sprind Bed. James R. Cole, Hoag's Corners, N. Y., showed a good bed spring. James H. Van Sice, Buffalo, showed an improved horse collar. J. D. White, Buffalo, showed an improved spring bed. R. W. Bell, of Buffalo, showed an assortment of soap. F. P. Wood, 89 Main street, exhibited beautiful specimens of work in willow, tubs, pails and brooms. Palmer & Wilber, Buffalo, exhibited the patent fire-extinguisher, what all need, as a recent fire in the city demonstrated. Bickford & Curtis, Buffalo, had good specimens of leather fire-hose on exhibition. T. J. Austin displayed a case of very rare old coins. S. Coleman & Co., of Rochester, took the first premium for sundry articles of hardware. Hadley & Nicholls, of Buffalo, had the first premium for a case of silver-plated hardware, glassware, &c. Sweet & Harvey, of Buffalo, exhibited several beautifully finished baby carriages. Felthousen & Russell, Buffalo, showed specimens of ship lamps. Fuller & Bray, of Buffalo, displayed an improved canal boat head light. O. B. Evans, Buffalo, had the first premium for a process of tanning domestic hides. Kedzie & Bunnell, Rochester, had a useful article in the shape of a water filter. The Western House of Refuge, Rochester, had the first premium for tubs and pails. G. G. Newman, Buffalo, showed specimens of electrotype plates. John Humphrey & Bro's, Buffalo, made a display of harness which is very creditable. Shirrell, Fisher & Co., of Buffalo, had a large lot of their famous Kulliyun washing crystal on exhibition. Donnell & Gridly, 20 Lloyd street, had a good assortment of lamps, machinists' oilers, &c. Herman Voight, 33 East Seneca street, showed specimens of artificial limbs, which we recommend to the legless. Gesellgen, Heinz & Co., Buffalo, made an elegant show of bird cages, water filters and coolers, and P. Vogt's refrigerator.

"Lewis Poh & Co., had a case of splendidly finished faucets. H. Thompson, Buffalo, exhibited some family soaps. P. M. Dentzer, Buffalo, showed eleven kinds of family soap. Lantz, Bro's & Co., Buffalo, showed three kinds of family soap. M. Strauss, Buffalo, displayed ten beautiful specimens of sheepskin roans, of all colors, and soft and pliable leathers.

"L. & A. A. Hoffman, No. 93 Seneca street, exhibited about as useful an article, in a small way, as we have seen at the Fair. It is

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a reversible and adjustable boot and shoe heel. One can turn it in all shapes, and need never 'run down' the heel.

"Shepard & Clark, of Buffalo, showed a self-locking blind hinge. Clark, Ruger & Co., also exhibited a patent sash-supporter. Clark & Garretson showed an improved sash lock. Clark and Co., enter the 'Gravity' sash lock. These are all useful articles, and manufactured in Buffalo.

"Dodds, McNeale & Urran, Cincinnati, showed an excellent combination lock and an improved safe. C. B. Curtis, of Owego, had a useful little improvement on door latches. Henry F. Holt, Fredonia, showed a patent buggy seat. L. J. Newlan, Waverly, showed an improved bolt and rivet trimmer. Charles A. Theobald, Buffalo, exhibited a patent sprinkler, and a very useful little article."

THE TUBE WELL.

In the Domestic Department was also found the Hershey tube well shield or joint, Parker & Lapp, and Hershey & Horner, proprietors. This invention is a kind of well that is being rapidly introduced in Buffalo. There were others on the ground, but none, so far as we could learn, were entered for competition.

THE GRAND SQUARE PRIZE PIANO.

The first premium was awarded to the newly improved Agraffe pianos exhibited at the Fair by the Central Piano Forte Company of New York. The committee which awarded the prize consisted of seven experienced musicians from various parts of the State—Mr. J. R. Thomas, the celebrated composer and vocalist, being one of the number. The same pianos had last week carried off the first premiums at the Pennsylvania State Fair, and they are evidently making a triumphal march straight to the top of the list of American pianos in reputation. The company manufacturing them is one organized two or three years ago upon the co-operation principle by some of the first workmen from Steinway's establishment. The instruments are upon the overstrung principle, and embody all the latest improved ideas. In tone, power and general finish, they are splendid specimens of American art. Speaking of the triumph of these instruments at the Pennsylvania State Fair, the Pittsburgh *Republic* says:

A splendid rosewood 7¼ octave piano of this make was placed upon exhibition at the State Fair in this city last week, which carried off the first prize—having been pronounced by the hundreds of ladies who played on it during the continuance of the Fair to be

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the finest and best toned piano they ever had the pleasure of fingering. In view of the innumerable unsolicited encomiums pronounced by these fair and artistic performers, the committee unhesitatingly award Messrs. Hammer & Teorge the first premium."

Clemens & Redington, of Syracuse, took the first premium for best parlor grand piano; also for the best family organs, and best church organ. Their display of instruments was a very fine one. The best collection of musical instruments was made by Cottier & Benton.

FLORAL HALL.

This was a large circular tent, in which there was an attractive show of fruit. The display of flowers, though fair, was less in extent and variety than at some former exhibitions. The fruit was arranged about the border of the tent, and the flowers in the center.

The beautiful greenhouse plants of Messrs. M. P. Bush and W. G. Fargo, of Buffalo, were fine specimens of horticulture, and were much admired by the visitors. They were all rare and beautiful plants, and require much care and skill in their culture.

Henry Linke, of Buffalo, made a beautiful display of flowers of nearly all varieties—pot-plants, bouquets, &c. Mr. Linke displayed a fine lemon tree, upwards of fifteen years old, bearing fruit. Two beautiful geraniums were much admired. Mrs. Linke displayed her handiwork in the shape of some ornamental flower wreaths and crosses, and merits much praise for her skill. Mr. Linke carried off six second and two first premiums.

Mrs. Mary Sorole, of Hamburgh, took three first premiums and a second premium for different varieties of flowers. Mrs. S. made a neat display of numerous varieties.

There was a fair show of cut flowers, but pots were exceedingly scarce. There was a case or two of single and double dahlias, of much beauty. The show of verbenas was very fine. Stocks of all kinds were not what might have been expected at this season. A most superb crimson cocks-comb ornamented the stand. German asters were, in general, small, but varied and perfect. Of the rest, there is little to be added, with the exception of parlor and hand bouquets, which were really beautiful, evincing much taste and skill in the selection and arrangement.

WAX, HAIR AND SHELL WORK.

The display of wax and feather flowers, wreathes, vases, &c., though not large, was fine. We give the names of prominent exhibitors:

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Mrs. F. R. Derrick exhibited a collection, among which the following occupied a prominent position: A vase of flowers in wax, comprising red, white, crimson, yellow and variegated roses, beautifully executed; a vase of common and white passion flowers, carnations, almond blossoms, companalas mimalus moschatus, and many lovely exotics tastefully conceived and admirably finished; a group of water lilies, resting on a mirrored surface, with lilies of the valley springing from the inner edge of the heavy gilt moulding which surrounded the whole. This piece had a most pleasing effect, and was the subject of universal admiration. A vase in wax, by the same lady, was an exquisite specimen of art.

A white rose and bud in vase, with leaves tinted with the bright and brilliant hues of autumn, by Miss Bloodgood, were worthy of that well known *artiste*, as was also an adjoining vase of white lilies in the same style.

Mrs. John Nicholson, of Buffalo, made a magnificent display of artificial flowers made from sea shells, wax, fish scales and feathers; and they were duly praised by all who examined them.

Miss A. De Etta Bloodgood, of New York, exhibited three vases of wax flowers, which were greatly admired for their beautiful and superior finish.

Mrs. L. Bedford, of Buffalo, showed three vases of fine wax flowers.

Mrs. E. Varney, of Buffalo, showed some beautiful feathered flowers.

Miss E. Bignell and Mrs. F. R. Derrick showed vases of splendid wax flowers.

Miss Delia Crittenden showed one case of feather flowers, which were very fine.

Miss A. Mischka, of Buffalo, exhibited a case of hair work and one of shell work. But Miss M. crowns all by her beautiful hair picture of Washington's tomb. It is a correct representation of the resting place of Washington, and is done entirely in hair.

Mrs. George Urban, of Buffalo, exhibited a fine bouquet of wax flowers.

There were numerous specimens of Indian bead work, which we have not space to speak of minutely.

Mrs. C. D. Alden showed specimens of fine worsted work, and Miss Delia Crittenden exhibited a neatly made worsted tidy.

Mrs. F. R. Russell displayed a beautiful embroidered baby dress.

Various specimens of needle work, &c., were shown.

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Valentine Otto, of Buffalo, exhibited a fine specimen of ornamented confectionery.

The Osborn Manufacturing Company exhibited some nice wire work in the shape of bird-cages.

Samuel B. Dewey, of Buffalo, made a splendid display of lamps, &c., of all descriptions.

P. Lies, of Buffalo, showed a case of millinery goods of fine manufacture.

Mr. McGeorge, of Corning, N. Y., showed a case of fine dentistry.

APPLES.

The show of apples was fine embracing great variety of superb specimens. The following sorts, among others, were displayed upon the stands: The Alexander, Hawley, splendid Ribstone pippins, Gravestein, York pippins, Tompkins County King, Golden Russet, Roxburghs, sweet Pearmain, St. Lawrence, Baldwin, Rhode Island Greening, Northern Spy, Maiden's Blush, Peck's Pleasant, Bailey's Sweet, Lowell Pound Sweet, Munson's Sweet, Red Astrachan, Summer Rose, Yellow Bellflower, Spitzenburgs, Detroit Red, Fameuse, and a large number of approved varieties.

Mr. Baker, of East Hamburgh, showed thirty varieties of apples. They were all beauties, and prove Mr. B. to be no novice in their culture.

R. H. Brown, of Greece, N. Y., displayed thirty-six varieties of apples.

W. Jackman, of Youngstown, showed eighteen varieties of apples.

Godfrey Zimmerman, Buffalo, showed sixteen varieties of apples, and several varieties of pears, which rank with any on the tables.

A. W. Sylvester, of Lyons, exhibited sixty varieties of apples and thirty of pears, prominent among which, with their bright rosy cheeks, rivalling the blush of a modest damsel, is the "Sylvester seedling."

There were several other lots on exhibition, but the owners not being present, we are unable to give their names or the number of varieties displayed.

E. Munn, of Buffalo, showed as lovely and luscious a plum as one would wish to see, and names it the "None-such"—a good name.

PEARS.

The varieties of the pear were nearly as numerous, and in point of perfection rivalled the apples, comprising a rich assortment of Virgalieu, Beurre Diel, Duchesse d'Angouleme, Belle Lucrative,

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Sheldon, Bergamot, Louise Bonne, Flemish Beauty, Bartlett, Vicar of Winkefield, and other varieties—some of mammoth proportions. There were also a few fine quinces on show, but no specimens of other fruits.

The largest exhibitors of pears were Ellwanger & Barry, of Rochester, who showed twenty varieties; E. W. Sylvester, Lyons, thirty varieties; G. Zimmerman, Buffalo, ten varieties; and Dr. D. Ransom, of Buffalo, thirty varieties.

GRAPES.

The show of grapes was large and excellent. The Pleasant Valley Grape Growers' Association of Hammondsport, exhibited a select variety of choice specimens, prominent among which were perfectly ripened Catawbas, which, with other late grapes, mature without difficulty in that section, free from blight or mildew. A new seedling, the Keuka, ripening early, and very hardy, is deserving attention; it is sweet and fine flavored, and may prove a good wine variety. Their show of Delaware and Diana grapes was a fine one, for which premiums were awarded.

C. L. Hoag & Co., of Lockport, displayed twenty-six varieties—the most prominent among them being the Iona.

J. M. McCulloch, Cincinnati, Ohio, showed Ives' seedling in perfection.

Jacob Moore, of Rochester, exhibited a new variety, called the Diana Hamburgh.

Godfrey Zimmerman, Pine Hill Nursery, Buffalo, showed twenty varieties, all very fine.

Ellwanger & Barry, Rochester, made the largest display of grapes, fifty-two varieties, showing great care in their culture, and fully sustain the well known reputation of the firm as fruit growers.

E. W. Sylvester, Lyons, showed the Oporto grape, a fine variety.

N. Bogue & Brother, of Attica, exhibited a splendid dark seedling, the Eureka, with large berry, and fair sized cluster, very hardy, ripening without difficulty, and strongly resembling the Isabella in appearance and flavor, and two or three weeks earlier.

M. P. Bush, Esq., showed two varieties grown under glass, of unsurpassed excellence, the Black Hamburgh and Muscat, of Alexandria, the latter of extraordinary size and beauty.

Mr. Joseph Duquetts, Lockport, four varieties, Black and Golden Hamburgh, Muscat, and a white seedling grape from the Muscat, and a great improvement upon its parent.

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In the amateur list, the Black Hamburgh, exhibited by John Tackle, of Buffalo, grown under glass, is worthy of particular notice. Richard Bullymore, of Buffalo, had also specimens of this variety—very fine.

DOMESTIC AND NATIVE WINES.

The success of the Pleasant Valley Wine Company for the past few years has established the fact that a superior character of wine can be made in our State from native grapes, and not inferior to choice grades imported from abroad. Their samples of sparkling and still wines, exhibited at the fair of 1867, received the highest commendations from those competent to judge of their merits. This company also showed a superior brandy distilled from grape wines.

The judges awarded them the large silver medal for the best sample of sparkling wine on exhibition, which was richly merited.

The Urbana Wine Company, of Hammondsport, N. Y., made a good display of sparkling Catawba and Isabella wines, with Isabella, Catawba, Delaware and Diana still wines.

An assortment of still and sparkling wines was shown by the Lake Shore Wine Company, of Brocton, Chautauqua county.

The Germania Wine Company, Buffalo, were also represented with fine samples of native wines.

Among the other exhibitors in this department, we may mention Dingens Brothers, Buffalo, exhibiting syrups, brandies and bitters; Jacques Brothers, Blooming Grove, Orange county, light wines; and J. McCulloch, Cincinnati, Ohio, who showed a sample of Ives' seedling wine.

The fine display of grapes and wines at the fair gives evidence that this interest is receiving increased attention in our State, and is being developed with success.

MECHANICS' HALL.

In noticing this department, we have relied mainly upon the reports contained in the Buffalo *Courier* and *Commercial Advertiser*, condensing and arranging the descriptions, and altering so as to correspond with our own notes, where we have found important variation.

Prominent among exhibitors in this department was Mr. David Bell, of Buffalo, who had on exhibition a patented steam hammer, a tug propeller engine, a donkey steam pump, a new propeller wheel, and models of the iron propellers which he has built. Pierce & Co., Buffalo, made a good show of machinery. Their shingle machine

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was in operation, doing good work. The machine for splitting wood was fully described by us in our report of the State Fair for 1865.

There was a creditable exhibition by Frank & Co., of Buffalo, whose mortising, tenoning, sash sticking and moulding machines occupy a good deal of space. E. & B. Holmes displayed a variety of their fine mouldings and clean cut staves. Davenport & Nelson, showed a section of cylinder boiler, riveted by a steam rivet machine.

There was on exhibition in this hall samples of horse shoe bar and railroad bars, entered by R. N. Brown, Esq., superintendent of the Buffalo and Erie railroad. These represented the Elmira Rolling Mills, and were forwarded to Mr. Brown, one of the stock holders, as a simple contribution to the manufacturing department of the fair, and without any reference to a premium. Many of the samples had been bent while cold; and others separated, displayed a fiber that seemed almost elastic.

SMUT MACHINE.

A singularly elegant specimen of the smut and separating machines, manufactured by Messrs. Exelby & Marshall, was exhibited by those gentlemen, and attracted much attention. It is made of black walnut and white ash, beautifully alternated, and the entire workmanship of the machine is exquisite.

AGRICULTURAL CAULDRON AND STEAMER.

D. R. Prindle, of East Bethany, Genesee county, had a good deal of attention directed to his patent cauldron and steamer, which must be regarded as a most convenient, economical, and efficient apparatus for steaming food or vegetables, and for general farm and domestic purposes. By means of it the cooking process is carried on at some distance from the steam generating apparatus, and at a trifling expense, and certainly no farmer ought to be without one. This machine is manufactured for the Southern trade, by Savery & Co., of Philadelphia. Mr. Prindle was one of the largest exhibitors for useful articles for farmers' use in Mechanics' Hall—including his corn-planter, seed-sower, horse power, flexible joint farm-roller, hydraulic paint for brick buildings, &c.

HYDRAULIC WASHER.

The hydraulic clothes washer and boiler, patented by Rev. M. W. Staples, in February last, is a real novelty, and as useful as novel,

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judging from the test to which it was submitted. It is constructed on philosophic principles; is self-acting, and dispenses with the labor of the washboard. In the boiler, the hot suds by the action of the fire, is forced up through tubes which discharges the same upon the clothes, carrying the dirt with it, and the improvement can be attached to any boiler in use. The finest laces cannot be injured by this process of washing; it saves time and labor, and costs but little.

THE COMMON-SENSE WASHER.

The "Common-Sense Washing Machine" was exhibited by Chas. Klingebeil, of Waterloo, Seneca county. The principle involved is productive of almost the precise results to be obtained by the joint use of feminine hands and wash-board.

THE LITTLE WASHER.

Among the other wonders at the fair, Richardson's Little Washer, the "Ladies' Favorite," was certainly neither last nor least, in the estimation of the hundreds of good housewives who crowded around it. Simple and efficient, it is easily worked, not liable to get out of order. The numerous certificates from heads of families of the most undoubted standing in the State recommend the "Little Washer."

THE GRAND PRAIRIE WASHER.

In the department of household labor savers, the "Grand Prairie" is useful as a table in a kitchen or wash house. Either ladies' lace collars, caps, fine needle work, or blankets, can be washed without the least wear or tear, and without breaking a button off of any kind of clothing—the washing being performed as well, and with less than one-fourth of the labor than when done by hand, The machine is entirely under the control of the operator, so that dirty parts of a garment can be washed without unnecessarily rubbing the clean parts.

FORCE PUMP AND BOLT MACHINE.

A very good thing on exhibition was a patent force pump, manufactured by Derrick & Peck, of Jordan, N. Y. The mechanism of this pump is a marvel of simplicity. It raises water from any depth, in a continuous stream, and never freezes. The only limit of its action is the power applied, and for ordinary purposes, that power is the slightest possible. It is an invention of value.

Mr. R. L. Howard exhibited, among other things from his extensive establishment, a powerful bolt cutting machine.

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THE DOMESTIC SPINNER.

Lazier's domestic spinner, exhibited by John Lazier, of Belleville, Ontario, Canada, was kept in operation during the day, and the ladies from the rural districts were particularly taken with the way it did its work. It occupies but little space; is very simple and ingenious, and is capable of spinning from rolls at the rate of forty knots, and of roving ninety knots per hour. It repeats the same amount of rolls, roving and twist; spins on the bobbin ready for the shuttle; reels, doubles and twists, and a warp can be taken off the reel. An intelligent person can learn to spin in an hour. It was awarded an extra prize at the Provincial Fair, held in Kingston, C. W., September, 1867, and is patented in both Canada and the United States.

CORN SHELLER.

A diminutive, but vigorously executive Corn Sheller, the invention of Lewis T. Newell, of Erie county, and entered by Torry & Wiley of Boston, same county, attracted a good deal of attention. It weighs eighteen pounds, is exceedingly simple in its construction, and is retailed at $8. It is essentially a household article, and can be operated effectively, even by a child. It does its work almost noislessly.

OTHER ARTICLES AND MACHINES.

Modern inventive genius was well represented in what was originally known as Vegetable Hall, but which after the accident of Tuesday afternoon, was given up to articles from the Mechanics' and Domestic Departments. The samples exhibited here, though few in number and variety, were of a very useful and substantial order. A noticeable feature of this department was that a majority of the articles are of a very recent invention.

Buffalo takes the lead in this building. J. D. Dudley showed a copper diving apparatus, or submarine armor, which is doubtless a very comfortable thing to wear in the water; two sizes of Judson's engine governor, and a low water alarm for steam boilers. Charles Bourgeois exhibited three fine specimens of the illuminated steam-gauge, one of which exposes the internal arrangement. It is a new invention, patented last year, and deserves success. C. W. Braun had a fine assortment of stone-ware, twelve pieces in all, embracing churns, fruit preservers, baking-dishes, and even lager-beer cups. F. P. Stiker showed three ponderous beer-faucets, an article of great utility where beer is imbibed; and J. W. Close has several

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models of an improved pike-clamp. J. B. Bull showed four large cast iron urns for ornamental purposes, attractive in appearance.

James McKelvey, of St. Catharines, C. W., exhibited a portable cream gatherer, or refrigerator and milk cupboard combined. Though a Canadian invention, it is extensively manufactured in the United States. It is so protected with composition lining and packing as to keep the inside perfectly dry as well as cool. It is a modern affair, patented last year.

G. Austin, of Denmark, Lewis county, had a "Milk Agitator," patented in March last. It is intended for use in cheese factories, and is evidently a great labor-saving apparatus.

Wm. P. Jones, of Troy, had several samples of anti-friction metal. This article has already taken diplomas at several State and County fairs.

Hawley, McClure & Co., of Utica, exhibited a fine lot of wares from their iron works, embracing pulley blocks, elevating blocks and grapples, wagon bob plates, skeins and boxes, Miles' bolster plate, dead eyes, whiffletree irons, etc. This firm was awarded the first premium.

G. & J. Tilford, of Rochester, showed four different kinds of carpenters' planes, and one plow, all made wholly of iron.

E. Thrasher, of Logan county, Ohio, showed fine specimens of the work turned out by Thrasher's Hub Borer. The hub is surrounded by an iron band mortised for the spokes, making a wheel of great durability. This exhibitor took a first premium.

J. T. Letchworth, of Union Springs, Cayuga county, had a set of hickory buggy spokes, a bundle of carriage-top bows, and a set of bent buggy felloes.

M. M. Smith, of Rochester, exhibited something of an oddity—the article being a staveless barrel. It is made of thirteen layers of white-wood strips, one-nineteenth of an inch in thickness—all being glued together.

Francis Brong, of Detroit, Mich., exhibited a mode of a singular contrivance for sawing stove-wood by hand. Two saws are driven by means of levers operating upon double-crank and belt-wheels. It doubtless affords vigorous exercise.

J. P. Stevenson, of Medway, Mass., had an improved nail extractor. It is manufactured in various sizes, and is used upon railroads.

William Smith, of Livingston county, showed a nip-pole extractor.

Daniel Smith, of Salamanca, had a sash-supporter. The window is kept in position by means of an iron eccentric in the sash.

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John Sheffield exhibited a double-acting oil pump, which is propelled by levers and cranks.

Wm. Gilfillan, of Syracuse, had what he calls an ever-lasting door and gate spring.

C. L. Pinney, of Ripley, Chautauqua county, had a set of three-horse whiffletrees.

C. C. Richardson, of Aurora, showed an apple quarterer, corer and stringer.

S. M. Welch exhibited ten sides of very choice sole-leather.

Preston & Herman, of Corning, displayed a hitching post and steps combined, and a specimen of substantial steam packing.

W. S. Payne, of Petroleum Centre, Pa., had an automatic barrel filler, self-cleaning. It is designed for the use of oil refineries, distilleries, &c., and is a valuable contrivance for the transfer of fluids from one receptacle to another.

J. B. Hendy, of Olean, N. Y., exhibited a substantial machine for making shingle bolts.

WEMPLE'S WATER FILTER, COOLER AND REFRIGERATOR.

This is a recent invention, shown by J. D. Wemple, of Albany, in which a series of economic advantages are secured in one article. It is not a simple ice-box, but is so arranged that the ice being placed in a trough above cools the air, while by its increased weight immediately flows down the passage-way, thus cooling the apartment below as thoroughly as above. This ice is at the same time employed for cooling the water in the reservoir, which is filtered, and being in close contact with it, water as cold as ice water is drawn in front. It is constructed on philosophical principles, is made both plain and ornamental, and is a valuable improvement in this line of inventions. It took the first premium, as it deserved.

THE SEWING MACHINES.

There was a splendid display of sewing machines at the fair, embracing all the leading and most popular machines, and the competition was decidedly spirited. The following embrace the different patents exhibited: Singer's, Wilcox & Gibbs', Howe's, Weed's, Wheeler & Wilson's, with Brewer's attachment; Leavitt, Florence, and Ætna.

In the contest for premiums the Singer machine, exhibited by Russell Crego & Son, of Utica, swept away the largest number, taking four diplomas as the best family sewing machine; the best button-hole machine, and the best embroidery machine. The Florence

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was awarded a diploma as the best double-thread machine, and Wilcox & Gibbs' as the best single-thread, while for the best sample of work the award went to that made by the "Brewer attachment." As the Singer machine seemed to be a favorite with the judges, we give what is claimed to be some of its new features.

The manufactures claim for their new family machine that all unnecessary complication is dispensed with, and a very rapid and noisless operation secured.

The shuttle is moved by a shuttle carrier instead of a shuttle driver, which does away with the wear on the shuttle, and also the greater part of the noise of the A machine.

The feed is very direct, and carries the goods perfectly straight, so that they need no guiding. It has an embroidery attachment, which has the advantage of leaving the embroidery on the upper side of the goods. It can also be removed at pleasure from the machine, which then leaves the regular lock-stitch alike on both sides.

BUFFALO, *October* 6, 1867.

I cheerfully certify that I gave the machines made by the Howe Sewing Machine Company, together with the several machines exhibited at the late Fair of the State Agricultural Society, a critical examination, and I take pleasure in stating that it is a machine in every way worthy of Elias Howe, Jr., the original inventor, and is justly entitled to rank among the first-class sewing machines.

HENRY WATERMAN,
Consulting Engineer, N. Y. S. A. S.

STOVE HALL.

The exhibition of stoves was very large—indeed more complete than any other branch of manufacture. Shear, Packard & Co., of Albany, exhibited their premium cooking stoves. Jewett, Church & Co., exhibited their famous "Legislator" cook-stove, which looks worthy of all the endorsements it has received. Felthousen & Russell, their mammoth "Olive Branch" cook-stove, for hotels, steamboats, and private houses, and smaller ones of the same description; also their Gas and Base-Burner combined; their portable Empire Furnace, all excellent manufacture. The same firm had other manufactures on exhibition in Domestic Hall. Kieffer & Hausle, A. Spitzmiller & Co., Geo. B. Bull & Co., exhibited their best stoves. Schwartz & Co., Buffalo, exhibited a range for families, and a furnace for warming houses, of much merit. There were about twenty-five exhibitors in this department.

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THE GAS GENERATOR

Of Messrs. Sloan & Carpenter, No. 11 South Division street, Buffalo. The two feet burners used by them on exhibition gave general satisfaction to all who had the pleasure of witnessing the light. This machine will produce a beautiful light at the rate of forty cents per thousand feet, and the gas machine can be built and operated at any man's house at a small expense. This company, we understood, will agree to supply the city of Buffalo with gas for the next twenty years at the rate of two dollars per thousand feet, and will give bonds for the performance of their contract.

SELF-SEALING FRUIT JARS.

Among the articles which attracted more than usual attention, was the Spencer patent self-sealing fruit jar, entered by O. N. Russell, general agent for Coleman & Barnes, of Rochester, N. Y. These jars are among the most reliable in the market, and are sold at a rate so low that every housekeeper can afford to purchase them. The canning of fruits is a science, and the firm of Coleman & Sons has brought it to perfection. The cans come at a cheap rate, and no charge is made for packages by the firm. Messrs. Coleman & Co. also received the first premium on hardware.

SPRING BEDS.

In the unending list of those who have contributed to the luxury of "tired nature's sweet restorer, balmy sleep," Mr. Abner Hitchcock, a Michigan inventor, takes high rank. His spring bed was near the entrance of domestic hall. The peculiarity seems to be that, in addition to the ordinary springs, he has added a wire frame work, which plays upon a second set of spirals—the whole forming a luxuriously easy resting place for tired mortals.

THE SPRING RUBBER BED.

Entered by C. C. Livingston, general agent. An elastic India rubber spring connects the wooden slats to any kind of a bedstead in common use, and can be covered with any common mattress—making one of the cheapest, easiest and most elastic spring beds ever invented, free from bugs, and very healthful. It is regarded as superior to many of the modern improvements or inventions for the same purpose, and is recommended to all who may desire a perfectly comfortable bed, free from the objectionable features of the spiral spring, at the same time giving abundant elasticity.

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FREIGHT WAGON.

Among the entries worthy of notice was a freigh. wagon from the manufactory of Mr. A. A. Justin, machinist and blacksmith, of North Buffalo. Mr. Justin had also on exhibition Wakeman's patent adjustable spring brace, which affords most perfect relief for horses' necks. The testimonials of this improvement are abundant, commending it to public favor.

THE SAMPSON SCALE.

The Sampson Scale Company of New York had a platform scales for weighing iron, hay, cattle and coal on exhibition. The principle upon which these scales are made differs, in essential points, from all others. The large scales heretofore used for the weighing of hay, coal, iron, &c., have the horizontal leverage power, which is more or less liable to spring and bend, according to the weight placed upon the platform—the levers varying in length from nine to fifteen feet. The lever of the Sampson scale is upright and short, being but *nine inches* in length. A load may be placed upon any part of the platform, without in the least affecting the accuracy of the scales. All friction and wear and tear caused by the oscillation of the platform come upon a system of yokes and links, preserving the pivot edge from injury, at the same time insuring the greatest accuracy.

This scale surpasses all others for simplicity, rigidity accuracy, sensitiveness, durability, compactness, facility and exactness of adjustment and adaptibility to location. Its parts are of less size and weight, and at the same time of greater strength than any other scale of the same capacity. The parts necessary for a ten ton scale are packed in a box one foot square by five in length, ready for shipment. The same scales with equal accuracy and facility weigh light and heavy weights, and when weighed down to their full capacity indicate the fraction of a pound.

The Buffalo scales were in operation on the grounds, and were of great excellence; and in all that makes perfect scales, none were superior to the machine upon the grounds.

FILES.

In the handsome building of Messrs. Pratt & Co., a number of Buffalo manufactures were afforded a local habitation. Among these the Wolstenhome File Company deserve special mention. They exhibited a case containing seventy different patterns of files, all of the finest workmanship; above them appear the words "*E. Pluribus Unum*," in what is technically known as "rasps," the whole making

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a very handsome show. The Wolstenhome company's establishment is one of which any city might be proud; in fact, it is one of which even the Birmingham of America can make a boast.

A NEW HAT.

The Empire Hat Company, Watertown, N. Y., showed samples of Manilla hats fitted in all colors, and waterproof. This is a new thing, and is one of the great inventions of the age. These hats are beautiful, and are not easily distinguished from those made from costly material, while their expense is comparatively a mere trifle. To show their waterproof capacity, one of the hats is in use as a wash-basin, and apparently uninjured.

FARM GATES.

There was a number of farm gates on exhibition, one of the cheapest, best, and most simple, being that invented by the Messrs. Buckmans, of East Greenbush, Rensselaer county, N. Y. It is a picket gate, running upon rollers to its center, when it is swung round at right angles. Mr. Buckman has recently made an improvement by fixing a roller in the center of the drive-way, and another outside or beyond the part upon which the gate moves when being pushed backward and forward. This is a very valuable farm gate, and is so easily and cheaply made and hung that it must come into general use. This gate can be made for from $2 to $3.

E. Pettys, of Chestertown, N. Y., exhibited the American gate, which is operated by a rocking shaft overhead, without leaving the carriage. The price of these gates are from $25 to $40.

James Gorris, of Cleveland Ohio, showed Betts' patent rock gate, which is operated by driving the carriage over an iron bow, which is so connected by a rod to the gate as to throw it out of center, and thus be made to open or shut.

The Empire gate, shown by T. C. Leggett, of Chestertown, N. Y., is another rock shaft gate operated by arms extending down from rock shaft, similar to the American gate. Price from $15 to $25.

Dixon & Close, of Port Byron, N. Y., also exhibited a self-opening gate, operated upon an improved plan. It was patented in 1866, and is worthy of success.

PORTABLE FENCE.

B. & V. Calkins, of Varysburg, Wyoming county, exhibited a very odd style of portable fence. It is an ingenious lattice-work, so arranged as to admit of being contracted or extended, thus giving any height, from eighteen inches to six feet. The exhibitors have arranged this fence in a circular form, in order to show that it can

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be used both as an enclosure for fowls or animals, and as a huge receptacle for potatoes, &c., in the field.

The Union Fence Company, of Painsville, Ohio, exhibited a combined ornamental iron and wood fence. The company also showed a very good style of farm fence—in short, have ten distinct designs, some of very elaborate ornamentation, and others of a cheaper design, yet neat, pretty and durable.

A NEW MACHINE.

On leaving Dairy Hall, a novel machine attracted our attention, located near a large stack of hay. It is an improved press for baling short-cut hay. The press is constructed with cones, and ingeniously constructed chains running upon the cones. The box is so arranged as not to waste the cut hay in filling. The hay is pressed from the bottom upwards, by the chains winding on the cone and drawing up the fallower. When the bale is secured, there is an arrangement for throwing out of gear, and the fallower drops with its own weight, and in the same manner is repeated. The Empire Cutter, manufactured at Rochester, is used. A crusher, consisting of two iron rollers, is attached, that crushes the hay—making it soft and pliable after being cut. There are two fans also attached, which blow out the dust after the hay is cut—a perforated screen preventing the hay from going out. The hay is then carried on an inclined elevator to the press. This is a recent invention, and has never before been exhibited. It will cut and press eight tons of hay per day, putting it up in neat compact bales, eighteen inches square by twenty-eight inches long, of two hundred and twenty-five pounds to the bale. The press costs $500 and the cutter $250. It is exhibited by C. Brown & Son, Buffalo, N. Y.

BRICK MACHINE.

Prominent among the many useful articles on exhibition were three different specimens of machinery for the manufacture of brick. The Empire State Brick Machine, exhibited by Wm. Van Vranken, of Schenectady, N. Y., commanded considerable notice. It is worked by either horse or steam power, and is capable of turning out about 25,000 brick per day ready for the kiln. Samuel Shreffler, of Joliet, Ill., showed another style of this machine, with a set of moulds for separate use. M. J. A. Lafler, of Albion, Orleans county, had still another, and also a set of moulds. Each of these machines produced specimens of its work in a crude form—being kept in operation upon the grounds.

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FARM IMPLEMENTS AND MACHINERY, &c.

The display of agricultural implements and machines was extensive, and one of the best ever had by the Society. The mowers and reapers were here in large force. Plows, cultivators, and harrows were well represented. Thrashers and cleaners, horse-powers, pumps, water elevators, portable engines, brick machines, horse-rakes, grain drills, and, in fact, almost every device for economizing labor upon the farm, were well represented. There was quite a number of new machines, while many of those most popular, and which have been before the public for some time, came to the exhibition with recent improvements.

HUSKING MACHINE.

Some have asserted that the corn crop is the most valuable of any grown in America, and that its failure in any one year would work commercial disaster, and entail suffering among the people. Every farmer who grows corn knows that one of the most tedious operations connected with the crop is the husking. In olden time, "husking bees" were common, and in many parts of the country they are yet in vogue. It will be a surprise to some to know that the days of old-fashioned "husking bees" are numbered, for a machine is now invented that will husk corn from the stalk in the most perfect manner, and at a most rapid rate. The American Corn Husker is a most wonderful machine, and a grand desideratum. It is a very simple machine. It has an inclined table, on which the corn from the shock is placed. The ends of the stalks entering between two corrugated rollers, are drawn forward until the ears are reached, which, coming in contact with an iron break, are broken off in the place Nature intended them to be broken, and fall upon two endless aprons working in opposite directions. Here the husk is caught and rolled or twisted off—the husks falling in a pile by themselves, and the corn going into another. So, in the operation of this machine, we have the stalks, husks, and corn all separated, and in different piles. This machine was patented by Scott & Farnum, of Blackstone, Mass., in February last, and costs $75. It is a most valuable machine, ranking in its labor-saving capacity with the reaper and mowing machine. Its merits are not alone in husking the ear rapidly and perfectly, but by separating the husks, they may be turned to good account for a variety of useful purposes. It attracted much attention.

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COW-MILKING MACHINE.

One of the novel things which especially attracted the attention of dairymen was the Hydraulic Milking Machine, which is claimed to do its work in exact imitation of the sucking of a calf. On the top of each stanchion is placed a small diaphragm pump, to be worked either by hand or dog power. The pump is connected with the milker on the cow's teats by an iron pipe arranged in convenient manner for use. Between the two iron plates forming the milker is placed a rubber diaphragm, forming four elastic partitions in the shape of a basin—one for each teat of the cow. Water fills the iron pipe and all the space from the diaphragm in the milkers to the pump on the stanchion. When the pump is in motion, the elastic partitions, which also separate the water from the milk in the milkers, move up and down, corresponding to the motion of the piston of the pumps, and with the same force, since the space is filled with water, producing the remitting suction required.

The milkers are self-adjusting, fitting cows of any size, and milking the four teats at once. They move up and down under the cow's bag, giving a bunting motion in imitation of the calf while sucking, and like it draw and stop drawing to swallow.

The machinery for this power is arranged out of the way, and the whole is constructed so as to milk a number of cows at once. Preparations were in progress for milking cows on the fair grounds with this machine, but we were not present at the milking, and therefore cannot speak of its practicability. If its operation, however, is as successful as is claimed for it, it may possibly prove a desideratum.

HAND AND POWER PLANER.

Read & Gordon, of North Brookfield, Madison county, exhibited a new invention and one of great merit. Simple, compact, not easily to be got out of order, requiring little room and small power. This machine traverses the timber operated by bevelled gears and worm—the knives cutting upon the Daniels principle. In testing this machine we found it to run easily and do its work in the most perfect manner. It took the first premium.

ROCK-DRILLING MACHINE.

This is a recent invention, shown by Downing & Hermance, of Schuylerville, N. Y., with which one man, by turning a crank with about the same labor as working a fan-mill, can drill an inch a minute in any ordinary rock. The drill is made to turn at every

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stroke, and is driven down by a coil of heavy wires. It did its work admirably, and must prove of great utilitv in this class of labor.

SAWING MACHINE.

N. Brockway, of Cambria, Niagara county, had a simple and admirable contrivance for sawing stove-wood. It is operated by hand power, and it is claimed to do as much work as three men with common buck-saws. The stick to be sawed is placed upon a platform, and is instantly secured by a clamp operated by a lever. The saw is suspended on a vibrating pendulum frame, and is worked backward and forward, making a long and rapid cut.

WATER ELEVATORS.

Among the water elevators, that shown by R. Brown & Co., of West Edmeston, Otsego county, appeared of great merit, on account of its simplicity, and not being liable to get out of order. It is a windlass without racket or wheel, having a peculiarly constructed stop and brake combined in one lever. It performs its work with ease and safety, stopping instantly, should the hand accidentally slip from the crank.

The devise for drawing water shown by Jones & Pasko, of Attica, N. Y., was also quite meritorious, as was the rotary pump of D. E. Kast, Mechanicsburg, Pa.

COMBINED CORN PLANTER AND PLASTER DISTRIBUTOR.

The use of ashes or plaster upon corn is a considerable benefit to the young plants. Ashes are not only serviceable as a fertilizer, but the potash which they contain is distasteful to worms and grubs, and when applied they act as a preventive to insects that might otherwise feed upon and destroy the tender plants. These fertilizers are usually strewed upon the hill by hand at the time of planting, or immediately after the first hoeing. It is evident that if a machine driven by horse power could be made to do this work with accuracy and rapidity, a considerable saving in time and money would be effected. Henry Rhodes, of Clarence Centre, N. Y., had a machine at the State Fair which not only drops and covers the corn, but deposits the plaster or ashes upon the hill at one operation. It sits upon wheels, has a seat for the operator, and is worked by one horse. This machine makes two furrows, planting two rows at a time, and the seed-droppers are followed by an arrangement which dumps the plaster, etc., upon the hill after the seed is covered, in any quantity that may be desired. It is a new invention, and appears to do its work well.

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WOOD-SAWING MACHINE.

Sawing stove wood by hand brings the muscles into vigorous play, and however strongly it may be urged as a healthy exercise for the man of sedentary habits, there cannot be much doubt of its being laborious when diligently pursued as a business. Francis Brossy, of Detroit, Michigan, had an improvement upon the old buck sawing arrangement, which consists of two hand-saws operated with two levers and driven with a wheel and crank. It does not wholly dispense with labor, since considerable muscle is required to turn the crank and keep the saws in motion, but the wood is cut more expeditiously and with more ease than by the old method.

PIPE AND CYLINDER WRENCH.

The great trouble with the old style of wrenches is that they will not accommodate themselves readily to all kinds of work. J. W. Close, of Buffalo, exhibited a wrench which appears to be an improvement in this line of implements. It is simply a pair of diverging jaws, with a spiral spring attached to the feet of one side, by which different sized pipes or nuts can be turned without any extra adjusting of the parts.

AGRICULTURAL PORTABLE ENGINE.

We do not remember to have seen any considerable exhibition of portable engines at our State Fairs, but this year E. W. Mills, of Syracuse, N. Y., exhibited a novelty, and so far as we could judge, an admirable invention. It is a portable engine, embracing the general principles of the stationary engine, but detached from the boiler. In this arrangement the boiler may be set at any distance desirable from the farm building, while the engine is stationed near the work, the boiler and engine being connected with a gutta-percha pipe. The engine is entirely encased, so as to prevent any trouble from dust. The boiler and engine being separate, and each upon wheels, are easily moved from place to place, which is not the case with ordinary portable engines of eight or ten-horse power. It attracted general attention, and was pronounced by those capable of judging, to be one of the best things in this line that had been invented.

HEATH'S DITCHING MACHINE.

Practical farmers have long wanted a machine for ditching, by which horse-power could be substituted for manual labor, and the work of ditching be made less expensive. Mr. Heath, of Fowlerville, N. Y., has attempted to supply this want in a recent invention,

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for the first time exhibited at our State Fair. The machine, when in operation, is placed upon a light movable track, for the purpose of leveling the bottom of the ditch. There is also a screw on the shovel, so that it can be raised and lowered, when the ground is uneven, at pleasure. The excavator and scraper derive their motion from the main shaft through the medium of a cross-head. The excavator begins to cut at the bottom of the ditch and throws the earth to the surface, when it is caught and removed to either side by the scraper. The machine is moved forward by means of a chain, anchored ahead by a stake. The chain, as the machine advances, winds over a toothed wheel into a box. The feeding works are very simple, and can be regulated by the operator to suit the nature of the ground. The power required to operate the machine is two horses and one man, with boy to drive. The horses are attached to sweeps, and the depth of the ditch can be varied from eighteen inches to three feet—the machine by once passing over the ground leaving the ditch complete and ready for the tile. It is claimed that this machine will work in gravelly or stony ground, and that on ordinary ground it will cut a tile ditch at the rate of from four to eight rods per hour. This machine was in operation on the grounds, and we do not see why it should not prove a useful and labor-saving invention.

FANNING'S BREAST DRILL.

This is an improvement to be attached to the common brace, by which four revolutions of the drill or bit is made for one revolution of the brace stock. It consists in a set of cog wheels, partly inclosed in a thin cup-like iron case, by which the increased motion of the drill is effected. It is quite simple, not liable to get out of order, and must prove of great value to mechanics. It is a new invention, just brought out by R. Onderdonk, of New York.

APPLE CORER AND SLICER.

Mr. Onderdonk also had on exhibition an apple corer and slicer, simple, and the best we have seen. The slicers are in form of a cup, and are held together at the bottom by a tube, which serves as a corer. The apples are placed in the cup, and are pushed through with a short lever, upon which is a convex block, just fitting the cup, being cored and sliced at one operation, and at the rate of a bushel of apples in five minutes.

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TILE MACHINE.

The tile machine, invented by John Lyth, of Buffalo, was in operation on the Fair grounds, and did good work. Its operation is similar to other machines, but the tiles differ from the ordinary draining tile, having four flat sides instead of being round like a tube. Mr. L. claims that tiles made in this form are more convenient to lay, while the inside circular shape may be better preserved in passing through the baking process. The machine turns out 3,000 tiles a day.

CATTLE STANCHIONS.

An objection urged against the common stanchion is that it confines the animal too much in one position. S. S. Safford, of Newtonville, Mass., attempts to obviate this difficulty by a swinging stanchion, which consists in an ordinary stanchion, so arranged as to turn on a swivel or hinge on one side. It can be made stationary, or allowed to swing as desired. It is claimed that the swing stanchion gives greater ease and comfort to the animal when lying down, but it seemed to us that possibly an opportunity might be given at times for the animals to hook each other. Trial will test its utility.

OSBORN'S DUMPING WAGON AND SELF-ACTING BRAKE.

This is an invention of Prof. Osborn, of Hamilton, N. Y. The box is upon rollers, and is operated by an expanding and contracting reach. In dumping, the horses are backed, which throws the forward wheels and load backward upon the rear axle, so that it can be at once discharged. The brake is a very ingenious contrivance, simple and powerful, and may be applied to any wagon. The invention is new and promises to be valuable. Another dumping box, worked by wheel and cogs, was shown by N. Clute, of Schenectady.

HAY-KNIFE.

H. M. Smith, of Kalamazoo, Mich., exhibited a novel hay-knife, having diamond-pointed teeth, with a stirrup on the handle. It is operated by placing the foot upon the stirrup, and thrusting the knife in this way through the hay.

RIDING ATTACHMENT FOR HARROWS.

Inventors seem to be determined that farm work shall be made easy, and every year we have some new device for saving labor. At the implement trial, Mr. Randall, of Adams, Jefferson, county, surprised the old-fashioned farmers with his sulky attachment for

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harrows, by which a child or an invalid riding upon a spring seat is enabled to do the work of a strong man at a great saving of clothes and shoe leather, to say the least. He had his riding attachment for harrows at the State Fair, and it was highly commended, and attracted much attention. This is a practical affair, the harrow is under perfect control, and the horses move along with more comfort because the driver can carry a steadier rein.

DISH WASHER.

One of the attractions in Domestic Hall, especially to the ladies, was the dish-washing machine of Samuel D. Sykes, Buffalo. It is of circular form, and of convenient size so as to be handled with ease. In using, the machine is placed upon a table or bench, with the crank at the right. The plates are set in the rack on each side of the machine, commencing the third notch from the end, with the inside of the dishes toward the middle. Small plates can be put in the corners when both sides are full. The cups, goblets, &c., are placed on the top, in such a position that the water will run out. Now close the valve on the right end, and put in from three to four quarts of hot water, with one or two table-spoonfuls of soap; close the top and turn the crank briskly to the right and left about one minute; open the valve, by raising the left end of the machine, the crumbs will more freely pass off in the water; then rinse off the suds by dashing over the dishes about a quart of hot water. Close the valve, and put in about two quarts of hot water; close the top, and turn briskly a few times; then open the valve to let out the water, and open the top to allow evaporation, and the dishes will be clean and shining. The ladies present, who saw this machine in operation, pronounced it a splendid invention, and we have nothing to say to the contrary.

TYRREL'S HOOF-EXPANDING HORSE-SHOE

Appears to be a good thing. A recess on one or both sides of the shoe, near the toe, weakens the iron, and permits the hoof to be gradually expanded. The flanges at the heel takes firm hold upon the hard portion of the hoof, by which means the foot spreads with the shoe. In throwing the walls outward and confining them to the angle required, the frog is released from contraction, and the healthy action of the limb restored.

PATRICK'S STOCK PUMP.

Patrick's improved pump for watering stock was on exhibition, upon which two patents have been secured, one dated May 1st,

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1866, and the other dated June 5th, 1866. A well watered farm is a blessing to the farmer, and in the absence of proximate streams, the amount of labor in watering stock is immense. By means of this pump, the stock water themselves. An inclined plane walk leading to a reservoir allows an animal to do his own pumping, without any danger of being frightened by the process. When the animal walks off the platform, by weights attached to the other end of the machine, the piston raises, and the pump is instantly re-charged for the next. The pump packing is perfect, and the machine is not likely to get out of repair.

DISPLAY OF THE PITTS AGRICULTURAL WORKS.

Not the least noticeable of the many specimens of invention and fine workmanship at the fair, are the machines exhibited by Mr. James Brayley. His thrashing machine is not only a valuable invention, but is also an admirable piece of workmanship, as are all the machines turned out at his establishment, the Pitts Agricultural Works. Mr. Brayley had also on exhibition four different applications of horse power. The one which involves the use of an endless chain being among the latest and most approved devices for applying power is known as "Perry's American Horse Power." It is a lever power working upon an entirely new principle, operated by a chain, working at the ends of the lever. As this power is now generally known to the public, we need not describe its general construction, but only refer to its recent improvements. These consist in a chain wheel that will run an irregular linked chain—a feat never before attained. The wheel is constructed with movable cogs—a part being constantly pressed inward, and a part outward, when the machine is running. There is an improvement for tightening the chain, and a number of other improvements in the jack. There were two sizes on the grounds, one for horses abreast, and one for horses single—the price being from $150 to $200 for the power, including the jack. The inventor claims that six horses on this power will accomplish as much as ten on any other. James Brayley, of Buffalo, is the manufacturer and exhibitor.

H. L. EMERY'S DISPLAY—THE COTTON GIN, ETC.

Among the displays made at the fair ground, there was none that attracted more attention than that of H. L. Emery & Son, of Albany, N. Y. Mr. Emery, Sr., has been present, and has always occupied a leading position at every annual State Fair since the year 1846.

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He is fully identified as an annual exhibitor, and the Albany Agricultural Works are widely known.

This year the firm had a cotton gin and condenser in full operation, with railway lever or saw mill power; and a large crowd was always standing around the machines, to witness what we seldom see in this part of the country, a cotton gin. The manufacturers have received the highest awards in Manchester, England, from the Cotton Supply Association; also in Georgia, Maryland and New York. This exhibition was near the south end of Mechanic Hall.

WHEELER, MELICK & CO.'S DISPLAY.

Among the machines exhibited by the well-known and enterprising firm of Wheeler, Melick & Co., Albany, N. Y., we noticed a three horse and a two horse railway power, with thrashers and cleaners attached. The working of these machines attracted great attention. We observed some features embodied in their construction which do not pertain to those of other manufacturers, and which must prove invaluable aids in the thoroughness of their work. Among these, in the powers, were endless chain links, dispensing with the transverse rods formerly deemed an essential feature, and a self-sustaining link with a cast-steel journal substituted, thereby securing unequalled lightness. In the thrashers and cleaners we observed a rotary crank-rake, which carries the straw entirely through the machine, perfectly separating the grain.

Their machine for thrashing and preserving straw works admirably, and is of great utility. It leaves the straw as straight as flail-thrashed straw, thrashing as fast as ordinary two-horse machines.

The thrashing done by these machines was thorough and complete, These machines have taken first prizes in New York, Pennsylvania, New Jersey and Indiana State Fairs.

They exhibited also the Palmer & Walker hay fork.

THE AMERICAN AGRICULTURAL WORKS' DISPLAY,

Represented by W. L. Burtis, New York city, and a number of assistants, showed a great many machines for agricultural purposes—only a few of which can be noticed at this time.

WRIGHT'S CULTIVATOR,

And Hilling Plow, exhibited by this firm, appears to be a valuable machine. The teeth or standard to which the cast steel points are attached are of malleable iron, and the peculiar shape of the teeth gives a motion which shoves out the roots of weeds and grass to the surface of the earth, and in the last time through there is a plow

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attached for hilling, which can be done without the use of the hoe at all. This plow can be adjusted to vary from two to four feet in width. The weight of the machine is fifty-five pounds—sixty-eight all told. The wheel and clevis in front regulate the depth of the cut. Price $10.50, and $16.50 with plow.

THE WIRE TOOTH RAKE,

From the American Agricultural Works, is simple in construction, with a wheel four feet two inches in height. The peculiar shape of the teeth lifts the grass from the ground, instead of drawing the grass upon the ground, as is the case with several other rakes. The dumping is done either by the foot or hand. We think it a very serviceable machine.

SMALLEY'S CORN PLOW

And Cultivator combined, also manufactured by the American Agricultural Works. By means of levers upon the side of the frame attached to the crooked arm or axle, they are enabled to raise or lower the frame to which the teeth are attached, so that the driver can plow from a half inch to six inches in depth; and it is so arranged that it can plow two rows at once by means of the right and left-handed plows, turning the earth to and from the crop. At the same time there can be attached four plows, all turning the earth one way, making a summer fallow plow. They also have attached to it seven cultivator teeth, making it a perfectly independent cultivator. The price is only $50.

PLOWS

The exhibition of plows, says the *Country Gentleman*, "was not extensive, but comprised several of value. Those noticed at the Utica trial were on the ground, including the several from F. F. Holbrook, Boston, and others. Alden & Co., of Auburn, presented several good steel plate plows. M. & G. Wiard, of East Avon, N. Y., had a number of their old and well known inplements, which have proved themselves efficient in stubble and on rough ground; The Keystone plow, from Anderson & Co., Lebanon, Pa., was short in form, and well adapted to rough ground; but its chief peculiarity was a cleaner, consisting of an iron plate, which, by touching a lever at the handle, was thrust forward, throwing out from under the beam any grass, straw or weeds which might collect there.

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RIDING ATTACHMENT FOR PLOWS.

J. & L. Bremer, of Buffalo, exhibited Dilt's self-holding plow. It has a wheel for gauging the depth and width of the furrow and a seat for the driver. It is self-holding, and is claimed will do good work.

THE SULKY PLOW.

This is an attachment which can be applied to any plow, the invention of John C. Rogers, of Alden, Erie county, N. Y. A pair of wheels and seat for the driver is in rear of the plow. A wheel with socket work and crank is on one side, by which the plow may be lifted out of the furrow when at the end of the land, or when coming to any obstruction it is desirable to pass over. When lifted up in this way, the plow is suspended from the frame work of the sulky, and may be moved from place to place, if desired. From this suspension principle it is claimed to be easier of draft than it would be if running in the ordinary way without the attachment.

BURCH'S IMPROVED "CHENANGO CLIPPER."

This is a swivel plow, with side draft and coulter. It is claimed to do its work well upon the steepest side hill. This is done by means of a side draft, allowing the horses to walk in the furrow, the plow running above and forming another, and so alternately. Exhibited by L. D. Birch, Sherburne, Chenango county, N. Y.

THE MORGAN HARROW AND POTATO DIGGER COMBINED.

Prominent among the implements of this character exhibited at the Fair, was the Morgan Harrow and Combined Field Cultivator and Potato Digger. As a harrow it took the first premium at the national trial that was held at Utica in September, 1867. Since that time the manufacturer, by a slight alteration and a small additional expense, has converted it into a field cultivator for pulverizing the soil. It has capacity to till the ground from six to eight inches deep, leaving the ground in excellent condition for a crop, and by its use potato land can be prepared for a crop of winter grain without plowing. As a potato digger we have good authority that it will dig, in the most perfect manner, from two to three rows at a time, and not cut them half as much as is usually done by the hoe and hook, and at the same time exterminates the weeds and pulverizes the soil. Mr. Morgan, of Deerfield, N. Y., the inventor, challenges all other potato diggers to compete with it in practical operation. It is sold at about $40, and is a valuable implement.

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FLEXIBLE HARROW.

Gibson & Ingles, of New York Mills, exhibited a flexible harrow made wholly of iron, and a very useful implement upon meadows and in breaking up top drainings, etc. It is an improvement on the English Implement.

GRAIN DRILL AND PLASTER SOWER.

P. & C. H. Seymour, of East Bloomfield, N. Y., exhibited their well and favorably-known Grain Drill and Plaster Sower—machines described by us in a former report of the State Fair.

Gardner & Co., of Carlisle., Pa., had on the ground one of Willoughby's Grain Drills. This drill by means of its admirably adapted rubber spring, passes over stumps and stones while sowing, without stoppage or breakage. It is one of the best, if not the best, grain drills in this country.

CULTIVATORS.

There was a large number of cultivators upon the grounds. The Excelsior Cultivator, shown by Ford & Howe, Oneonta, Otsego county, N. Y., appeared to attract considerable attention, and is an excellent machine. It is a new invention, for the first time shown at our fairs. There were two sizes—the larger for preparing the soil broadcast, and by a slight modification to work in drills. It has shovel blades, and suspended from a frame upon wheels, similar to those of a mower—a slotted tongue pivoted on the forward part of the frame, enabling the driver to see the row, and by swaying from side to side to accurately guide the machine from his seat.

The shovel blades are made to enter the ground at such an angle as to give a light draft. They can be put in the ground at any depth required, can be widened or narrowed at pleasure, and raised at will to pass any obstruction. For cultivating corn, hops or roots, this machine seems well adapted.

The one-horse machine is provided with thills, and weighs about eighty pounds, and works well in all soils. The price of these machines are $60 for the large, and $20 for the one-horse. This took a premium at the September trial.

Alden & Co., of Auburn, N. Y., made a splendid display of implements—chief of which was their thill and other cultivators, variously modified for different purposes. One was arranged for three horses, to be used for a broadcast cultivator, and was one of the best things of its kind on the grounds. Another was converted into a quack rake—being furnished with sharp teeth, and would doubtless do its

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work in the most efficient manner. These cultivators operate admirably in furrowing, covering and hoeing potatoes—finishing two rows at a time. We noticed upon one a corn-marker attachment. The different changes and variety of purposes to which these cultivators may be put, make them exceedingly valuable, and at the same time the cost is quite moderate, compared with other machines for doing similar work.

Nourse's one-horse hoe is made to expand or contract with the width of the row. It has an iron frame, and is an efficient and durable implement.

Clark's Self-Adjusting Cultivator, exhibited by W. F. Clark, Hagaman's Mills, N. Y., is provided with a seat for the driver. The teeth are elevated by throwing the weight backward, thus enabling it to pass obstructions. Several of the cultivators shown have been previously described by us in our former reports of the State Fair.

GRAIN DRILLS, ETC.

There was a good show of grain drills. Gordon & Co., of Carlisle, Pa., showed their gum spring drill, which is claimed to be efficient over the roughest ground. Price $90.

Abbott's patent corn planter plants two rows at a time, and is upon wheels. Shown by George Abbott, of White's Corners.

Long's combined seeder and roller was exhibited by Peter Low, of Cherry Valley, N. Y.

Seymour's grain drill, manufactured at East Bloomfield, N. Y., has been previously described by us.

Lewis Larchar, of Utica, N. Y., showed a seed and corn planter.

Burleigh & Bolt, Spencerport, N. Y., a plaster and seed sower, which could be attached to a common wagon—a cheap, and, we should think, valuable machine.

J. T. Champlin, Aurora, N. Y., also showed a seed sower and planter.

A cotton seed planter was exhibited by N. B. Sherwood, Milville, N. Y. Price $100.

POTATO DIGGERS.

In some parts of the country potato culture is carried on as a specialty, and large crops grown for market. Digging potatoes by hand is slow and expensive work. Besides, it is often desirable to finish up digging rapidly during pleasant weather, when a large force of workmen cannot be had. A machine, therefore, which

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can be worked by horse power, doing the work of many, is a desideratum which has not escaped the eye of the inventor, and so we have quite a number of devices for this purpose. The following are the leading machines exhibited:

Shenck's potato digger, shown by J. S. Combs, Stafford, N. Y., and manufactured at Holendale, N. J., sets upon wheels, and has a shovel for throwing out the potatoes upon a vibrating rake in the rear. It is operated by cog wheels attached to a piston, on the same principle as the mower and reaper. The machine is claimed to dig five acres per day.

J. C. Clark, of Elmira, N. Y., showed a potato digger, which consists of a bowed piece of iron with a sifter in rear, raising and falling, and operated by drive wheels.

A. Mercellus, of Shortsville, Orleans county, N. Y., exhibited the Basket Potato Digger. It has a double bowed shovel plow, with rake attached, raising and falling. The drive wheels are basket-shaped, allowing the dirt to sift through as the potatoes are thrown into them. The potatoes are elevated by the wheels and dropped on this rack, and left in the rear of the machine.

The Champion Potato Digger, exhibited by H. J. Kintz, of Greece, N. Y., is operated by two horses. It has two hooks in front which clear the track, placing the vines in position. The divider passes directly under the hill, raising the potatoes up to a point where they come in contact with a rotary sifter, driven by two side drive wheels, which screens out the earth, and leaves the potatoes to pass over on a gatherer in rear. This leaves them clean on the surface and ready for picking. The machine will dig five acres per day, and its moderate cost puts it in the reach of every farmer. This appears to be a valuable machine. J. W. Mount, of Medina, N. Y., is the manufacturer.

L. A. Aspinwall, of Albany, N. Y., exhibited a potato digger, operated with two horses. It has a roller in front which rolls down the vines. The earth and potatoes pass over vibrating fingers in rear of a wide shovel plow, operated by two drive wheels with gearing.

HAY RAKER AND LOADER.

The hay raker and loader of H. Baker, of Cortland, N. Y., and known as the "twin brother of the mowing machine," created no little sensation among the farmers from various parts of the country, who witnessed its operation on the grounds during the afternoon. Many of them, together with one of the committee on machinery

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improvements, expressed their opinion that it could, if desired, rake and elevate to the wagon 3,000 pounds of hay in forty seconds.

GRAIN SEPARATOR AND CLEANER.

E. C. Patterson, of Rochester, exhibits a Chicago Grain Separator and Cleaner—combining fanning mill and separator. This machine separates clover seed from timothy, and rye from wheat, and is a great favorite.

MOWERS AND REAPERS.

The mowers and reapers were on the ground in abundance. The *Buffalo Express* gave an extended notice of this department, from which we quote, making such alterations as seems proper:

"Among the many machines introduced was one by the Dodge & Stevenson Manufacturing Company, of New York, that attracted attention on account of its new self-rake attached for the next year. The peculiarity of the machine is the complete control it is under to regulate the size of the bundle by the driver. It has four rakes acting as a reel, excepting when a gavel was necessary to be made. then the driver can make either rake take off a gavel at pleasure, it working equally well in tall or short grain, without adjusting.

THE BUCKEYE

Mower and reaper, manufactured by Hiram Curtis, at his agricultural works in Albion, N. Y., is quite a favorite in Erie county, there being not less than 700 of them now in use. It was first brought prominently before the public at the grand national field trial of the United States Agricultural Society, held at Syracuse in 1857, when it carried off the grand gold medal. At the trial in Auburn, in 1866, the first prize grand gold medal in class one was awarded to the Buckeye machine for superiority in all the points selected by the judges as the essentials of a perfect harvester. The judges said: "The result of this trial clearly shows that it still keeps the forward rank which it won at Syracuse, and at many other subsequent trials, and that it is still as worthy the patronage and confidence of the public as it has been in any preceding portion of its history."

ADRIANCE, PLATT & CO.,

of Poughkeepsie, had two of the famous Buckeye mowers, with Johnson's raker attached, on exhibition. They are exceedingly well made, of the very best materials, and attracted unusual attention by their splendid appearance. The large number of premiums awarded

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to this machine are enough to prove its qualities, and Messrs. Adriance, Platt & Co., say that "mowing machines are an American invention, and the manufacturers of the Buckeye, having received the highest honors from American judges on American fields, do not consider that awards from foreign countries could improve their reputation with American farmers.

THE NEW YORKER.

is the name of a class of machines manufactured by Messrs. Seymour, Morgan & Allen, Brockport, Monroe county, N. Y. Two of them were on exhibition at the State Fair—one a reaper and the other a combined reaper and mower, and both had self-rakes.

THE VALLEY CHIEF.

which was on exhibition, had been used three seasons in the field. The machines were made in Lewisburgh, Union county, Pa., and are in good repute throughout the Keystone State. The cutting bar can be raised or lowered to suit the condition of the grain, and the gavels can be made of any required size. It has the Marsh rake attached.

THE UNITED STATES,

a neat machine, manufactured by Wm. J. Risedorph, of Albany, N. Y., of wrought iron, and weighed but six hundred pounds. It received a fair share of attention from the farmers, and was well liked.

THE EUREKA MOWER,

invented and manufactured by Mr. J. D. Wilber, of Poughkeepsie, N. Y., is a direct draft machine. "It leaves the grass in a better condition for drying than any one that was in competition at the Auburn trial. One of the horses walks in the standing grass, and the other in the space left by the clearer, and in this way all trampling on the grass is avoided."

THE COLUMBIAN,

entered by W. L. Burtis, President of the American Agricultural Works of New York, is a machine composed of iron, excepting the poles, and, of course, is not liable to wear out. It turns corners easily, and the motion of the knives is retained all the time. The bevel pinion takes its power direct from the main gear, on the main shaft—the spur gear being located on the shaft with the bevel pinion, and meshes into the spur pinion on the crank shaft, consequently avoiding all twisting and straining, causing it to be nearly noiseless.

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The seat is in the rear of the bar, and the lifting motion can be operated by the motion of the driver's body. The wheels are thirty-six inches in diameter; the sward cut is five feet wide. It can be changed in a few moments from a mower to a reaper, with the tables and knives set at any angle for the perfect cutting and easy delivery of the grain at any height from the ground which may be desired. It has a perfect self-rake attached, with beater so arranged as to beat down the lowest grain.

The Columbian, Jr., embraces all the valuable elements of the large size machine, and is adapted to the wants of a class of farmers who desire, at a moderate price, a first class mower of smaller size and lighter weight and draft. It is constructed wholly of iron and steel, has double driving wheels, hinged finger-bar, and folding cutting apparatus. It is light, simple, durable and efficient; is easily understood and managed; cuts a swarth four feet two inches wide; leaves the grass perfectly spread.

THE PERRY MOWER,

entered by the Ames Plow Company, of Boston, Mass., was one of the machines at the Paris Exposition in 1867, and received one of the highest prizes for doing its work quicker, easier and better than any other instrument. The editor of the Chicago *Prairie Farmer* said: "The Perry completed its second round in advance of all the others of its division, the two-rounds occupying but twenty-nine minutes. The last swarth was cut the entire length without a stop—a feat accomplished by no other machine during the day."

THE EXCELSIOR MOWING MACHINE

is constructed so as to combine every point of excellence requisite for the work to be done with the greatest simplicity, and it is claimed that this machine is not surpassed in strength, ease of draft or management, and adaptation to cut in the most perfect manner all kinds of grass; and it will work on steep hillsides and over uneven ground under circumstances in which other machines fail. It has a solid iron frame, and of course is not affected by the weather.

THE WORLD'S REAPER.

This is a new machine, exhibited by Mr. J. W. Doty, of Lockport, for Messrs. E. Ball & Co., of Canton, Ohio, and is peculiar in its construction. The frame is of solid iron, and is in a single piece. It has no joints to work loose, and the bearings cannot

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change their relative positions. The gearing is all cut from the solid iron in the most perfect manner, and runs with the precision of clock work. The bolts are all turned and fitted to their places to a nicety, thus avoiding all danger of working loose. The gearing is all enclosed in a tight iron case, which effectually excludes all dust, dirt, water, and everything which tends to the destruction of machinery. It is made as a combined machine and also as a mower. As a reaper it is made to suit all the various tastes and wants of the farmer, being furnished with a self-rake of the most approved construction, a dropping apparatus and hand rake attachment. The dropper is a nice arrangement, said to deliver its grain in the best manner, even better than the self-rake, at a much less expense of power, its lightness requiring no more power than the single mower. It is made in the most perfect manner, and no materials are used in its construction but the very best, and must be a very durable and popular machine. As an evidence of the favor with which it has been received by farmers, we are assured that the manufacturers have sold all their machines, and have had a large number of orders which they could not fill.

THE EAGLE MOWER AND REAPER.

In the Mechanical Department, among the many attractions, our attention was particularly turned to the working of Harrington's Patent Eagle Mower and Reaper combined, manufactured at Valley Falls, Rensselaer Co., N. Y. Either end of the finger bar can be raised independently of the other, over obstacles, at any desired height; can be folded for transportation and unfolded for work without the driver leaving his seat; runs neither wheel on the cut grass; changes the motion of sickle from fast to slow or slow to fast in a few moments.

As a combined machine, it is noted particularly for its self-rake attachment—it being under the direct control of the driver at all times, raking the sheaf at eight or thirteen feet, at his option.

THE CAYUGA CHIEF.

Combined mower and reaper, with automatic and controllable self-raker, entered by C. Wheeler, Jr., President of the Cayuga Chief Manufacturing Company, of Auburn, N. Y., has been before the public for seven years, and the fact that 5,000 of them have been manufactured during the past year may be taken as evidence of merit. This is the second season of the adaptation of the self-raker, which has been run with entire success. It is now con-

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structed wholly of iron and steel—the very best of iron being selected, and cast-steel used for the finger-bar and connecting rods. Its principles of construction are such as will best ensure a mathematical uniformity, and certainty that each machine and part is the exact counterpart of every other machine and piece, and each part being numbered, any desired piece can be ordered by its number, without danger of mistake. The finger-bar and cutters can, in a moment, be folded to the side of the machine, with their points downwards, in which position the width of the machine is diminished to that of the main frame, making it very compact, so as to require but little room for storage. When thus folded, the machine is perfectly balanced, and can be transported on its own wheels to any place desired.

The frame and gearing is mainly supported on two wheels, both of which are driving wheels. These act either independently or together, in vibrating the knives, so that the cutting is kept up in short turns, and in cutting around corners. By means of springs and pawls, either or both wheels are put out of gear in backing. The change from reaper to mower, or *vice versa*, is easily made, and the machine performs its work equally well in either capacity One of the strong points of the drop is, that it leaves the gavel in a square nice shape for binding—said to be even better than the hand self-rake; its lightness renders no more power necessary to run the machine than as a single mower. Another great feature of all these machines is the graduating lever, by the use of which perfect adaptation to the surface of the ground is secured.

THE KIRBY.

The Kirby machines, three in number, were entered by Mr. D. M. Osborne & Co., of Auburn, N. Y. One was a mower, one reaper, cutting six feet, and five with Burdick's self-rake, which is adapted to all kinds of grain and in all conditions—lodged, standing, stout, or short. The following advantages are claimed: It can be so arranged as to reap grain when lying almost flat on the ground; and it will reap when the wind is blowing without clogging or gathering on the rake. It will take off a sheaf once in ten feet or once in twenty feet, accordingly as the state of the grain will warrant, leaving the gavel perfectly square to bind, without using the hand-rake.

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THE UNCLE SAM.

Fisher, Hall & Diebold, of Buffalo, showed one of their Uncle Sam Mowers and Reapers. The firm have added a connecting rod, which is a great improvement.

F. Stevens, of Syracuse, exhibited one of Johnson's Self-Raking Reapers, manufactured by C. C. Bradley & Son, of Syracuse—a machine that does its work excellently.

Among the other machines upon the ground were the famous machines of Walter A. Wood, mower and reaper, Thayer's Iron Mower, manufactured at Trumansburgh, and Our Own Star, from R. L. Howard's well-known works.

A. W. Peel's draught attachment for harvesters attracted considerable attention. It is manufactured at Rome, N. Y., and is an improved and valuable attachment.

HAY TEDDERS.

There were two styles of hay tedders on the grounds. The Bullard tedder, S. S. Whitman, Little Falls, N. Y., agent, is now well known to the public as a very valuable labor-saving implement, which does admirable work in the hay-field. It has recently been greatly improved, having flat steel forks, and substantial workmanship in all its parts.

The American hay tedder, exhibited by Burts and Garfield, Boston and New York, is a new implement, constructed on the revolving principle like the English machines.

HAY RAKES.

There was quite a number of horse-rakes upon the grounds, the most of which have been previously described in our former report, and in that made by Mr. Harris.

REVIEW OF THE THIRTY-FIRST BRIGADE.

At half-past two o'clock, October 3d, the Thirty-first brigade, under command of Brigadier-General W. F. Rogers, was reviewed by Major-General Howard and staff, in the lot adjoining the grounds. The brigade consisted of the Sixty-fifth regiment, Colonel Flach; the Seventy-fourth regiment, Colonel Baker, and the Ninety-eighth regiment, Colonel Abbott, with a company of the Fifty-fourth regiment, from Rochester, accompanied by Newman's band. The Union Cornet and Miller's bands were also present. The brigade turned out over a thousand strong, and the parade

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was one of the most creditable which has taken place for a long time.

At the conclusion of the review, the managers of the fair admitted the soldiers within the grounds without charge.

SERENADE.

About five o'clock, and just after the review, one of the military bands appeared at the office of Gen. Patrick, President of the Society, and favored him with a serenade. A large crowd of people assembled in the vicinity, and loud calls were made for Gen. Patrick, who responded with laconic brevity, returning his thanks for the compliment.

CONCLUSION.

We have now gone over the leading features of the exhibition. Of course, the names of a large number of exhibitors have been omitted, since it would be impossible for us to examine and take notes of every article. If we have omitted to make mention of any new invention, we shall be glad to be notified of it by the exhibitor, that we may give the proper additions; and we shall be happy to make corrections where errors have been made, or injustice done.

In conclusion, we may remark, that the evening discussion during the fair were largely attended at the court house in Buffalo, and were animated, interesting, and instructive.

The eulogy on the late Gov. King, by Hon. J. Stanton Gould, was an appreciative and eloquent tribute to the character and services of one of New York's most distinguished sons—a friend to agricultural improvement, and long identified in promoting the best interests of the State Agricultural Society. It was listened to with profound attention, and the after speeches indicated the deep feeling and sympathy awakened in the audience.

Of the immense number of people who thronged the grounds during the exhibition, we cannot help believing that a large portion were benefited, and returned to their homes with ample material for thought that must promote the best interests of agricultural and its kindred arts.

If the great exhibition of 1867, shall not have taught its beneficent lesson to thousands, then we are greatly deceived.

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DISCUSSIONS

AT THE NEW YORK STATE FAIR, BUFFALO, 1867.

APPLE CULTURE—ITS PROFITS, &c.

BY HUGH T. BROOKS OF WYOMING COUNTY, NEW YORK.

Gentlemen of the New York State Agricultural Society:

How to produce the most food, and the best, for the use of man, was always a pertinent, and will soon become a pressing question.

If wars, heretofore so destructive of human life, shall cease according to prophecy; if the conditions of health shall receive respectful attention from all who are not ready and willing to die; if doctors shall get into a way of curing people, the world will soon be very full of inhabitants, and it will take a great deal to feed them.

The food question is the pressing question of all times. It divides itself into two parts: 1st. How can we secure an abundant supply? 2d. How can we improve the quality? The subject for discussion to-night bears directly on the whole matter.

It is held that famine must fix the boundaries of human life—"population must be limited by the means of subsistence." I hold that He, who guides the whirling planets on their way by exactly balancing the centrifugal and centripetal forces, knew how to limit human life without calling that gaunt skeleton, famine, to his aid. His laws for the increase of our species essentially harmonize with his laws for the development of sustenance. Men have shut themselves up in stone-walls and died of starvation, but the great store house of nature ocean, earth and air, was ever full to overflowing with material for them. It is your business, and it is mine, to develop nature's resources, so that all who come shall be fed and clothed—this beautiful world, portal of the world beyond, and all its offers, should never be closed against any by sloth, improvidence and crime. Woe to the man whose pride, folly, or lust shuts the gates of being and of bliss. Our "titles" in this world are leases during good behavior.

I make these remarks to indicate the extensive bearing of our subject, and the earnestness of purpose and the energy of action we should bring to its solution.

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I appear before you on this occasion to advocate the enlarged cultivation of apples in the State of New York; because in that way, better perhaps than in any other, can we augment healthful human food. By no earthly process, in my opinion, can so much nutriment be so cheaply extracted from four square rods of ground as by planting an apple tree in the center, and giving it good cultivation.

I have been at great pains to compare the best products in various departments. Forty bushels of wheat to the acre is very rarely obtained. Gen. Mills, on the Genesee Flats, in Livingston county, N. Y., once raised forty-seven bushels and eleven pounds to the acre upon eighty acres. Capt. Scott, of Covington, Wyoming county, N. Y., about the year 1822, raised five hundred bushels of wheat upon a ten acre field, it being fifty bushels to the acre. It was drawn to Albany by "seven horse" teams, then used for the transportation of merchandize westward, and produce eastward. Simon McKenzie, of Caledonia, raised sixty bushels of wheat to the acre, which must be accepted as the maximum product.

Gen. Mills is said to have raised one hundred and fifteen, and John Sheldon, of Livingston county, one hundred and sixteen bushels of shelled corn to the acre. One hundred bushels of oats to the acre has been frequently produced, and four hundred bushels of potatoes. Paul C. Sprague, of Covington, raised one hundred bushels of potatoes on a fraction over an eighth of an acre, it being at the rate of seven hundred bushels to the acre. About that amount of onions has been raised on an acre, and we will estimate carrots at double that quantity.

We will estimate as about the largest possible yield—corn at 140 bushels, wheat sixty, potatoes 700, and carrots 1,400 bushels to the acre. This would give three and a half bushels of corn, one and a half of wheat, seventeen and a half of potatoes, and thirty-five bushels of carrots to four rods of ground. Now let us see what an apple tree occupying the same space has done.

Mr. Dodge, formerly of this State, now of Maryland, picked sixty bushels of apples from a tree twelve miles from Washington, District of Columbia.

Major Bumphry, of Rochester, reports a tree that gave seventy-five bushels of apples at a single picking.

Will any one dispute that seventy-five bushels of apples are equal in nutritive value to three and a half bushels of corn, one

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and a half bushels of wheat, seventeen and a half bushels of potatoes, or thirty-five bushels of carrots? We get seventy-five bushels of apples from four rods of ground. If any gentleman will tell us how we can in any other way obtain an equal value of food from the same land, I will pause while he enlightens us as to the process—no one volunteers the information. I am not done yet. Col. Hannum, a prominent and reliable citizen of Genesee county, N. Y., informs me that he picked from a tree in Massachusetts, apples for ten barrels of cider, being at least eighty bushels.

A. J. Downing, in his "Fruit Trees of America," states that a tree in Duxbury, Mass., bore in a single season one hundred and twenty-one and a half bushels of apples. I doubt whether the world can show a more valuable grain or vegetable product from the same area. These are extreme cases, both as regards apples and the products I have compared them with.

We will now take ordinary yields. Potatoes have been regarded as the cheapest food in general use, but of late years, their average yield is less than 100 bushels per acre.

After diligent inquiry, I am satisfied that the orchards of Western New York, taking one year with another, good culture (if such case ever occured,) and bad, will average four bushels to a tree, or one hundred and sixty bushels to the acre. Wheat will not exceed fifteen, and corn thirty-five bushels to the acre; so we get one and a half of apples for one of potatoes, four and a half for one of corn, and ten and a half for one of wheat. The comparative value of apples is an open question, but there is no doubt that the apples in this comparison are greater in nutritive value than either the wheat or the potatoes. Corn is a marvellous crop, nutritious and productive in an eminent degree—the country that can produce it well should hold more than one "thanksgiving" in a year; but I think that four and a half bushels of apples are about equal to one of corn, and for the purpose of mixing with dry or concentrated food the apples are preferable. For feeding cows or hogs, I would boil or steam two bushels of apples to one of meal. Rather than feed meal clear, I would exchange one bushel of corn for four and a half of apples.

The apple orchards of Western New York, I think, actually yield 160 bushels to the acre, but you will bear in mind that they have not exclusive possession of the soil; other crops of grass or grain are usually grown on the same land. Apples need the ground. the whole of it, and all it contains, but "immemorial usage" allows

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an apple tree no rights that husbandmen are bound to respect; it is haggled and mangled roots and branches, and the soil exhausted in the production of other crops. Charging the apples with the ground they actually grow upon and appropriate, they give far better returns as food for man or beast than corn, wheat or potatoes.

But there is another item that puts all rivalry out of the question. The outlay in raising the apples is not one-fourth of what it is to produce the crops I have introduced for comparison. I submit that apples are the cheapest food.

Let us now examine the profits of growing them for market. New York, particularly Western New York, has a character at home and abroad for fruit. If a better apple country was ever made, I confess I never heard of it. We occupy the precise position where the tree is hardy and healthy, and the fruit comes nearest perfection. Farther north, the growth is not free and fair; farther south and west, if the flavor is as good, the texture is coarser, and the keeping qualities imperfect. This has been disputed. Mr. Sanders, the eminent horticulturist, of Washington, assures me that there are apples at the south that keep quite as well and are quite as good as any of our northern apples. I would not willingly dispute so high an authority, but I may safely say that these long keeping southern apples have generally kept themselves modestly hid from most of the dealers in our principal markets, and have not always been visible to sojourners at the south. A. J. Downing says, and I think truly, that "the apple is the great fruit of temperate climes." It is not a tropical fruit. It grows in all our southern States, and it grows in all our northern and eastern States, but it grows best in our middle States.

California grows apples successfully, the Bellflower being a favorite variety. The San Francisco market is abundantly supplied with such as are raised in the neighborhood, until the first of January, when they fail, and the market is supplied from Oregon, a more northern locality. The apple certainly grows most successfully in our middle States. It is there it has attained prominence. There the great apple dealers go for their supplies. There, large orchards are being planted to furnish southern, western and eastern markets. There, peculiar advantages exist for producing desirable fruit, or a great many people are very much mistaken.

Subjected to a critical examination, I have no doubt it will be found that the best apples grow in the central apple producing regions. In my mind, there is no more doubt that the apple belongs

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pretty well north, than that the orange belongs pretty well south. A resident of our Russian Possessions, writing from Sitka November 2d, says: "Six years ago the Governor obtained from Victoria apple, pear and cherry trees. They have been carefully trained, are thrifty, and this year's growth of foliage is yet untouched by the frost. They blossomed about the 1st of June, and a few dozen apples and a few pears attempted to mature, but failed. A quart of pale-red, insipid cherries completes the yield of fruit in the only orchard in this part of Russian America."

This shows that the apple tree grows, and is thrifty, as far north as latitude fifty-eight, only two degrees south of Greenland—that is very far from being tropical. Inferior fruit will be found as we approach either extreme of our apple producing region.

Ohio formerly produced a great many apples, but of late they have greatly declined. Michigan has a plentiful supply of good apples, but they do not keep well. The Greening is there a fall apple, and Russets and Spys ready for use in January. Missouri has good claims as a fruit State, and some of the timber borders and clay soils elsewhere; but in general, the western soil is too stimulating, and climate too variable, for apples.

Mr. Hugh Webster, now in the fruit and grocery trade, Buffalo, and for many years partner in a large fruit business in Milwaukee, says that his firm always lost money in Ohio fruit. He prefers Niagara and Orleans county apples. The Chicago dealers have a well known preference for Western New York apples, and well they may have, for in April, May and June, when the market is best, western fruit is in bad odor, while our Baldwins, Spys and Russets open fresh and sound.

Let us look to another quarter. Bennett, Rand & Co., Boston, Mass., extensive dealers in fruit, prefer to make all their purchases of apples in New York. Mr. Bennett assures me that our apples are the best in the New England market, and that we may depend upon a growing demand for them; their home supply has seriously diminished, and he advises us to plant largely of Baldwins and Russetts, and also of Greenings, Dutch Pippins, and Ribbston Pippins, with the full assurance of a good market. Confirmatory of the above, I give the testimony of that honored and eminent horticulturist, Hon. Marshall P. Wilder, of Mass.:

"DORCHESTER, MASS, *Jan.* 20, 1868.

"MY DEAR SIR: On examination of a huge pile of mail matter which arrived during my absence in Europe, I find a letter from

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you. Our apple crop has been poor in New England for several years, and I do not think the western growers have anything to fear from competition here. The apples from New York compare favorably with, and are generally superior to ours, except in favored locations, new soils, or where they receive special cultivation and care. The canker worm and borer affect the trees, as in other sections, and the remedies are seasonable attention.

"Yours with respect,

"MARSHALL P. WILDER.

"H. T. BROOKS, Esq."

We will now inquire into the actual profits of apple growing for several years past. It is generally admitted that our orchards, in full bearing, yield an average product of one barrel to the tree, of marketable fruit. There is a great difference in the productiveness of different sorts. The Spitzenburg, Fall Pippin, Yellow Bellflower, Fameuse, and other highly esteemed varieties, are now seldom planted because they produce light, or the fruit is imperfect, while the Roxbury Russett, Baldwin, Greening, Twenty Ounce Apple ,Talman Sweeting, Dutch Pippin, &c., bear very much better. The yield of an orchard very greatly depends upon the kinds of fruit, as well as upon the vigor and healthfulness of the trees. Some orchards fall below a barrel to the tree, while others greatly exceed that amount, as I will presently show. I beg leave to observe that every orchard that comes short of that amount, ought either to be "digged about and dunged, or hewn down and cast into the fire."

The average price of apples at Cuylerville on the Genesee Valley canal for the last ten years was, in the fall, $2 per barrel, and in the spring $2.80; forty trees to the acre, yielding one barrel each; would give in the fall $80 per acre; sold in the Spring $112. One man near that place has just sold his crop of seven acres. He has sold twenty-two hundred bushels, which have netted him, clear of expenses, $6,600, or at the rate of nearly $1,000 an acre in one season. An acre devoted to grass would not give more than $12, or to wheat or corn more than $25. As an average for Western New York, during the same period, tobacco, hops, and some other exceptional or exceptionable crops, may have paid as well as apples, but they cannot generally be resorted to. One of the best crops I have seen reported was cranberries at Manchester, N. J.

I know of no ordinary farm crop that at all compares, during a

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series of years, with apples, if we take into the account the small expense at which they are raised. Should we reduce the yield to one-half barrel to the tree, apples would still be our most profitable crop.

But I boldly claim that the average of our orchards could be doubled by good cultivation. What has been done can generally be done again. Large yields are by no means uncommon. Eleven barrels of apples (three bushels to the barrel), were picked from a tree belonging to Mr. Wilson, of Middlebury. Four trees yielded fifty-three and one-third barrels of Greenings, in Le Roy. Patrick McEntee, of Perry, Wyoming county, picked fourteen barrels of Baldwins from one tree, drew them at one load, and sold them for sixty dollars. Enos Wright, of Middlebury, sold the product of two trees for one hundred dollars. James G. Shepard, of Alexander, Genesee county, sold, in 1865, 350 barrels of apples for $1,575, they being the product of eighty trees growing on three acres of land. Mr. Hammond, of Middlebury, Wyoming county, N. Y., sold the fruit from thirty-three trees of Northern Spys for $900.

J. S. Woodard, of Hess Road, Niagara county, N. Y., sold, in 1865, from fifty trees (several varieties), ninety-six barrels of fruit at $4.85 per barrel, amounting to $465. In 1866, from the same, sold forty-eight barrels for $187; and the present year he got one hundred and fifty-six barrels from the above fifty trees, occupying less than two acres, sold for $421. This orchard gave an average of two barrels to the tree for the last three years. Three men in the town of Newfane, Niagara county, sold, in 1867, 2,700 barrels of apples. One of these, Mr. Peter Shavers, has ten acres of orchard, mostly grafted ten or twelve years ago, near the lake shore; soil a gravel, six feet deep, with clay beneath; timber, oak and chestnut: trees pruned lightly every year; standing twenty-seven feet apart, which he thinks too near; crops every year with corn, barley, or oats; plows five inches deep, and manures every third year with forty loads barn-yard manure to the acre. This orchard of ten acres yielded, in 1865, 300 barrels, $5.40 per barrel, $1,620; 1866, 360 barrels, $3.95 per barrel, $1,422; 1867, 750 barrels, $2.75 per barrel, $2,062. Average per acre for the three years, forty-seven barrels, which sold for $170 per acre. Crops have been light the last three years. John Broughton, of Covington, in 1867, sold $550 of fruit from eighty trees, or $190 per acre. He trims every year, and plows and manures every other

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year. Mr. Charles Cronkhite sold the apples on three or four acres for $1,000, unpicked. They were immediately re-sold on the trees for $1,500—a caution to careless salesmen.

Mr. N. R. Davis had this fall over five hundred barrels from four acres of land—three times as many as I estimated the general average of our orchards to be. One of his trees was reported to me as promising a very remarkable yield. I requested J. S. Woodard, Esq., of Niagara county, to ascertain the exact amount when the apples should be gathered. Not being able to be present, he suggested a committee of prominent citizens to witness the gathering of the fruit. I will give you the result:

"YOUNGSTOWN, *Oct.* 15, 1867.

"J. S. WOODARD, Esq.:

"Dear Sir—We have picked our Greening tree, and I hereby certify that the said tree has grown and produced twenty-six barrels apples of the above description this present season.

"Yours respectfully "N. R. DAVIS.

"*To whom it may concern:*

"We, the undersigned, at the request of Mr. Davis, have acquainted ourselves with the facts; and some of us were present at the picking of the said tree, and we most cheerfully corroborate the above statement. The tree is over fifty years old, is a large, healthy and vigorous grower. Mr. Davis' orchard has a very large yield of the first quality of apples, owing both to good soil and good care.

"B. M. ROOT
"IRA RACE,
"A. G. SKINNER,
"GEORGE SWAIN."

This remarkable tree is about two miles from Lake Ontario, on the banks of Niagara river. It will be observed that this is a Greening tree, as many others were that gave very large crops. A distinguished horticulturist, George Ellwanger, of Rochester, said that if he could have but one apple tree, it should be a Greening.

Edmund Morris of N. J., the admirable author of "Ten Acres Enough," wishing to do some tall bragging, tells of twenty apple trees near Philadelphia, whose product one year sold for $225. I have a story about twenty-two apple trees, which I sent a shrewd business man to enquire about; here is his report, full of instruction:

"Mr. BROOKS.—Dear Sir: Robert McDowell, of York, Livingston county, N. Y., has twenty-two apple-trees, grafted nineteen years

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ago, to Dutch Pippins, Greenings, Russets, Swaar, Gilliflower, Twenty oz., and Seeknofurther. The trees stand thirty-five to forty feet apart; soil sandy loam, commonly planted three years in succession with oats, corn, wheat, &c., then rests two years. Every year (please notice this,) it is manured thoroughly. Sold from twenty of these trees in autumn of 1865, to A. W. Wheelock, 142 barrels of fruit, for $674.50; sold from same to other parties, twenty-one barrels, for $105, amounting to $779.50. Some culls were reserved for family use. A forest about forty rods distant incloses this orchard on three sides, being open to the south.

"Le Roy, *September* 23, 1867.

"Respectfully yours,

"N. B. KEENEY."

Mr. McDonald owns but three acres of land; it is well manured and cultivated.

S. J. P. Smead, Bethany, Genesee county, has six acres of orchard. Soil clay, and strong clay loam, somewhat slaty. Sold 1862, 750 barrels for $2,370; 1863, 590 barrels for $1,790; 1864, 600 barrels for $2,100; 1865, 810 barrels for $4,500; 1866, 157 barrels for $863; 1867, 670 barrels for $3,000.

Here is only one light crop in six years; if we add to the above, apples reserved for family use, his orchard has actually produced 100 barrels to the acre, and two and a half barrels to the tree for the whole six years, and it has paid him over $400 to the acre for the whole time. For practical cultivators there is a fact connected with this celebrated orchard of great significance. It is an old orchard; for some ten years after it had come into full bearing it was allowed to take care of itself, in deference to the prevailing practice, and during those years it did no better than ordinary orchards. A new course was adopted. It was annually and prudently trimmed, heavily manured, plowed very shallow and left for another year, then cross-plowed and harrowed and suffered to lie two years without being cropped. The same process was then repeated—the results I have stated to you.

If this is not evidence tending to show that the product of apple orchards may be doubled with good cultivation, I confess I do not know the nature of evidence; and yet in my town it is well known that I am a justice of the peace in full blast. Another justice of the peace, George Tomlinson, Esq., reports that Safford P. Lord, of Pavilion, bought a neglected and unfruitful orchard, trimmed,

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manured, and plowed it, when it bore abundantly, and yielded the owner six thousand dollars in six years, there being seven acres.

An ancient cultivator was of opinion that "digging and dunging" was good for fruit trees. You can read about it in the New Testament. A. W. Wheelock, an extensive orchardist and dealer in apples, is of opinion that orchard products may be doubled by good cultivation. J. S. Woodard, Esq., of Niagara county, who has kindly assisted me in collecting facts respecting apple culture, says:

"I have found that an orchard cannot and will not bear large crops unless it is well manured. A friend of mine in Wilson takes extra care of his orchard, and gets annually on an average about seventy-five barrels per acre. The next farm west has an orchard of about one hundred old trees that did not yield over twenty barrels. My friend came in possession of it three years since, manured it regularly and heavily, pruned it annually, and the first year got fifty-six barrels, the second ninety-two, and this year one hundred and thirty barrels.

"Our best crops this year are in the north part of our county, on the first plateau above the lake, from fifty to one hundred and and thirty feet above the water level.

"I give you a fact to illustrate the value of manure. An acquaintance of mine drew his manure five years ago and piled it in his orchard between two large trees of twenty ounce pippins, a variety not noted for large bearing. These two trees had borne only every other year, and then not over from seven to nine barrels; since the manure deposit, they have borne every year from eleven to twenty-one barrels."

The first great fault in the ordinary management of orchards is the impoverishment of the soil by promiscuous cropping. An acre of ground that will produce forty barrels of good fruit, onght to be excused from growing grain. Whatever grain or root crops are grown upon it, detract doubtless more than they are worth from the apple crops. We cannot, without great expense and trouble, return to the soil all the elements which our wheat, corn and potatoes take from it. When I hear of trees standing near a wood pile, in the corner of a fence, near the barn, or the hog pen, or the kitchen door, I am prepared for a big yield. The great majority of our apple trees are either starved or go very hungry. There are few instances of very large yields, except where the tree, by an adroit, strategic movement, has backed itself up against a wall, a

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building, a morass, a barn yard, or something that would shield one side at least from its remorseless plunderer man, and give it something to eat.

The tree I alluded to near Washington, which bore sixty bushels of apples, stood near the house. Maj. Bumphrey's tree stood near the fence, in a sag of great fertility; the one bearing eighty bushels stood beside a swamp. Mr. Downing gives no particulars about his tree, but you may be assured it had a great deal to feed upon. From just such instances the true theory of cultivation must be deduced. Question those venerable trees, they can tell you more than you have ever learned. Our inquiries in this world are generally frivolous or far off. Let adepts in chemical and geological science dig over the soil about these trees, scrutinizing every grain of sand, or clay, or vegetable mould, or mineral found there, and report the secret of an almost miraculous production.

Why, sir, the Yale boys, with their geological professor at their head, go kiting over rocks and mountains, hammering away where nothing grows or can grow, while that dear old apple tree down there in the Bay State, for more than a century piled high over the ground its golden fruit, unquestioned and uncared for.

Not long ago a fellow over the ocean, peeking about among the stars, discovered a new one; forthwith he got it heralded in all the newspapers in Christendom, when, as you and every sensible man knows, we had more stars before than we could count, or knew what on earth to do with. If he had bought a good microscope, and turned it down towards the earth he might have seen something that would do somebody some good. We need to know what our fruit trees require; to scrutinize closely the condition of fruitfulness and healthy growth, and we want all the assistance that men of science can render.

A free application of barnyard manure is indispensable to the continued growth and productiveness of our orchards. Ashes, lime, plaster, and perhaps other mineral fertilizers may be used to great advantage. They seem peculiarly calculated to produce fruitfulness, and are especially commended for that purpose by an eminent German author. It should be remembered that the apple tree is subject to the general laws of vegetable growth. You cannot have large and fair fruit if the soil is poor, hard and dry. The earth should be mellow to secure suitable moisture in hot, dry weather, and to impart needed nourishment. It will not do to secure these ends by deep plowing, especially where plowing has been long

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omitted, and where a tenacious sub-soil has forced the roots near the surface of the ground, but a free use of the cultivator may be recommended, and the spade-fork is an invaluable instrument that should be often resorted to. Begging pardon of the Pomological Society, a tree knows better where to put its roots than any man can tell it; the spade-fork leaves the roots undisturbed. Mulching with leaves, straw, coarse manure, weeds, chip manure, shavings, muck, leached ashes, applied in the fall, or in the spring after the ground has become warm, will be of great service. Mulching is nature's method of cultivation, covering the earth with leaves enriches the soil and makes it light and acceptable as no other process can.

I should add that in a loose soil roots extend to a great depth. S. Hawley, Jr., of South Warsaw, planted an apple tree fifteen years ago. The spread of its branches is now twenty-eight and a half feet. Having occasion to dig a well five or six feet from it he struck the rock at a depth of seven feet and there on the rock found the roots of the apple tree an inch through. A deep, loose soil will, I think, add greatly to the size and productiveness of a tree.

Prominent among the calamities of which our orchards are victims, is bad trimming which my friend J. J. Thomas writes me is "worse than no trimming at all." Trees have a tendency to produce a surplus of wood; if it all remains, the branches are feebly nourished and some die of starvation after robbing the others. I think that trees, like grape vines, need to be renewed and invigorated by a prudent removal of branches. Summer pruning has a tendency to check growth, and trees are sometimes killed outright by severe pruning after the leaves attain nearly their full size. Trees large enough to bear sometimes, produce no fruit in consequence of vigorous growth; a moderate summer pruning may induce fruitfulness without serious injury to the tree. Thorough pruning from October to April promotes growth and vigor. The month of March is generally preferred, as trees just trimmed suffer from the intense cold of winter. I have trimmed in October with good results. There should never be any necessity for removing large limbs. Every branch not wanted should be taken off while small. Trees that are vigorous and not very old, would bear the loss of their large limbs better than aged ones; but it is always better to cut off none but small branches. It is impossible to grow apples fair and well flavored on a tree crowded with superfluous

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branches. Its sluggish circulation and dense foliage which excludes the sun, can furnish nothing but gnarly and insipid fruit.

I will add that a tree always branches low, and this inclination should be respected. Trees with low heads stand firmer, their trunks are less exposed, and their fruit is much easier gathered. Mr. Francis, of York, Livingston county, N. Y., picked from such trees that were well cultivated, and had large and fair fruit, thirty-two barrels of apples in a day. I have seen apples at such perilous heights that no sound life insurance company would be willing to take a risk on the picker's life, and so small that he would have to work hard to pick five barrels in a day. A tree with low branches has some means of defense from a remorseless plowman. If the limbs come close to the ground, they operate as a mulch, keeping the soil loose and moist.

Trimming should always be carefully done, the branch being smoothly cut, without leaving a stub to die and produce decay, and prevent the healing over. It cannot be too often insisted upon that the pruning should be done every year, or every other year at the furthest, so that superfluous sprouts may be removed before they attain much size or draw largely from the resources of the tree.

Whoever would have a good apple orchard must begin right. A deep, strong clay loam, or lime stone gravel, with clay sub-soil, is to be preferred. It should be under-drained if it inclines to be wet. If not rich enough to produce a first rate wheat or corn crop, manure it heavily, plow it and cultivate it with corn or potatoes one season. Then select stocky, thrifty trees, with good unmutilated roots; dig large holes and place the trees in straight lines, working with great care the best of the surface soil with your hands compactly among the roots, adjusted to their natural position. When the hole is nearly full, pour in a pail of water; fill up with earth after the water has soaked away, and press it down gently with your feet, letting the tree stand at the same depth as in the nursery row. If set in the fall, they should be made fast to a stake; and if in a windy place, they should be staked always and kept erect till they attain their growth, taking care to prune so as to balance the top. Thorough tillage and mulching will generally guard them against the drouth, but if they wither, severe pruning and watering may be resorted to, covering the ground immediately with litter to prevent its baking.

I would caution against setting out orchards on all soils and locations, even in the heaven-favored State of New York. The

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counties of Niagara and Orleans have been particularly successful in growing apples. Genesee, Wyoming, Livingston, Monroe, Ontario, Yates, and some sections adjoining eastward, are also well adapted to that business. But there is a very great choice in locations even there. Choose the best spot on your farm for your apple orchard. If it is every way suitable, there is nothing more profitable that you can devote it to, provided you give continuous care and attention to its wants. Light sands and all cold, wet and sterile soils are to be avoided. There is no very great choice in the exposure; I have seen good orchards sloping all ways. But it is quite desirable to be sheltered from the winds. It is difficult to keep trees erect and symmetrical in a windy place, and quite impossible to avoid great loss from the falling of the apples. You will please remember that Mr. McDowell's twenty-two trees (the apples reported were from twenty trees) were sheltered on three sides. They gave more than eight barrels to a tree, as their testimony in favor of protection and good cultivation generally.

Curtiss & Co., apple dealers, Boston, Mass., while giving emphatic testimony in favor of Western New York fruit, certify that apples grown upon clay are worth fifty cents per barrel more for late markets, than those grown upon light soils. Morris, Brothers, Rochester, give the same testimony. Allegany and other high southern counties contiguous, fail occasionally from frosts, but their apples generally do well, and are conspicuous as good keepers.

I will here remark, that if "fruit preserving houses" succeed, the question will be, which is the best? not "which keeps the longest?" But if they in any degree violate "the order of nature," as all artificial processes do, the quality of the fruit will be impaired. The apple as an ornamental tree deserves consideration.

My friend James Vick, of Rochester, N. Y., sends annually over the North American Continent, multitudinous packages of tiny seeds (I will not dispute but they are good of their kind), that are nursed and nurtured with womanly tenderness and care through the chills and damps of spring and the drouths of summer, and all for the sake of a frail flower that sheds a brief lustre, distils a faint fragrance, and soon withers, without feeding anybody.

Look at that orchard in the month of May! It transforms beauty into magnificence, and magnificence into beauty. It loads all the air with fragrance, and the more than regal splendor of its dress of pink and purest white would throw you into ungovernable exstacies, if promised benefits did not subdue sentiment.

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In the rear of the fine mansion of Leonidas Doty, Esq., of Batavia, N. Y., stands an apple tree thirty feet high, seven and a half feet circumference of trunk; its majestic top covers an area one hundred and fifty feet in circumference. It bears abundantly; sometimes as many as fifteen barrels of apples in a year. Seats have been constructed among its branches, where a dozen or two of persons may sit in spring time, embowered in blossoms and enveloped in fragrance—were it not the most useful, it would be acknowledged the most beautiful object in the landscape.

In advocating the extension of apple orchards, I do not forget that as we increase any product, we increase its insect enemies, and perhaps contribute to the spread of disease; nor do I forget also, that He who gave us our earthly benefactions, gave us also (unless he meant to tantalize us,) the means of protecting them. I deem it my duty to say, that he is very unwise, who embarks in an extensive fruit undertaking without counting the cost. He must give a great deal of personal attention to the details that I have mentioned; wormy fruit should be consumed by hogs, or carefully gathered and fed to animals; the army worm and other depredators must never be tolerated. The products should be gathered at the right time, with great care, and put up for market with scrupulous honesty.

With a favorable location and with proper management, the growing of apples may be safely pronounced a most profitable business. I do not believe one acre in fifty of our best apple soils, is now devoted to apple growing. I do believe that the consumption of apples can be very largely increased, by furnishing a larger supply suited to all seasons of the year. They can and ought to be grown much cheaper than the present prices, and even then will constitute the most profitable, as well as the most useful crop, of Central and Western New York.

I beg leave to add the testimony of eminent physicians and men of science to their value as human food. I will read a letter from John H. Griscom, an eminent author and physician of the city of New York:

"Mr. H. T. BROOKS:

"Dear Sir—Your favor reached me two days ago. Would it be advisable to extend the cultivation of apples in the State of New York?

"I respond most decidedly in the affirmative. No other fruit is in so great demand, nor any so desirable for health and gratification

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of taste. The apple is especially valuable on account of its peculiar acidulous element, the malic acid, which is a good aid to the digestion of other articles of diet, as well as of the apple itself. Almost all vegetable acids are important as promoters of the assimilation of food, and the malic is especially so by its influence upon the biliary and other digestive functions.

"As the only true source of pure vinegar also, that fruit, in an abundant supply, is a great desideratum to enable us to avoid imitations of that article. The apple is also valuable on account of its long, self-preservative properties, rendering it more extensively available for use than almost any other fruit.

"The sour variety is better adapted to these general purposes than the sweet, as it contains a larger proportion of the acid, but both are eminently available for good uses.

"Respectfully yours,

"JOHN H. GRISCOM."

"P. S.—An abundant supply of good cider as a substitute for alcoholic beverages would avoid a large amount of social and hygienic trouble. Dr. James C. Jackson, the head of a large hydropathic establishment, Dansville, N. Y., leaves few articles of drink or diet unchallenged, but emphatically indorses apples and other fruit. Dr. Campbell, formerly of the west, now managing a successful health institution at Avon, N. Y., speaks of apples as especially valuable in counteracting, in southern and western latitudes, bilious tendencies and malarious influences."

An eminent and leading physician of this city (Buffalo), Dr. James P. White, gives his views as follows:

"Having been requested to express my opinion of apples, I earnestly recommend their more extensive cultivation, so they may be furnished at cheaper rates as every day food for the people. They are nutritious, operate favorably on the digestive organs, and frequently obviate the necessity of resorting to medical remedies.

"My opinion is confirmed by my own personal experience in their daily use for several years. The juice of the fruit is, in my opinion, held in too light estimation. It is not only a pleasing beverage when properly manufactured and preserved, but it is useful as a promoter of digestion, and may often be prescribed with great advantage as a remedy for dyspepsia and kindred affections. The apple, either cooked or raw, and its juice, act very favorably upon the excretions, and especially upon the liver and kidneys."

Dr. C. C. F. Gay, of Buffalo, concurs with the above.

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Dr. John D. Hill, of Buffalo, says: "The general use of apples in their season, as a reasonable portion of diet, would be beneficial and conducive to health. The sweet are richer in nutrition, and supply a greater portion of adipose matter; but during the autumn and winter months the subacids are preferable as hygienic or prophylactic to the diseases of this climate."

From a multiplicity of other testimony, I will only add that of Charles Downing, Esq., who, equally with his distinguished brother, A. J. Downing, is a very high authority in all that pertains to fruit. After referring to several other points, he speaks of apples as food:

"NEWBURGH, *September* 24, 1867.

"Friend BROOKS—I think it advisable to plant more orchards in the State, because I think it more profitable than any other use the land can be put to, except it is the growing of small fruits, where there is a good market.

"Are the apple orchards in this State mismanaged? As a general thing they are, as far as I have seen them.

"What are the most serious defects in cultivation? Want of deep plowing, manuring and thorough stirring of the whole ground before planting. If wet or clayey soil, it should be well drained.

"What are the objects in pruning? To admit air and sunshine, and bring out the good qualities of the fruit. As a general thing, I think we prune too much, especially when in a bearing state. When young, they should be so thinned as to render it unnecessary to cut out any large limbs when the tree begins to bear. Thinning of fruit would pay double or treble the expenses, and the trees would be longer lived.

"Ought apples to constitute a larger portion of our daily food? Yes, and at breakfast is the best time, and it should be a portion of the meal; and if the person is of costive habits, fruit should be the first of the meal, and if otherwise, the last part. No fruit or anything else should be eaten between meals if we wish to keep well. People generally eat too much meat and not enough fruit and vegetables. Even hard working people do not need meat more than once a day. Wheat and other grains should constitute the largest portion of our food, as being less stimulating than meat, and more enduring. The American people are naturally too much excited.

"Most truly yours,

"CHARLES DOWNING."

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I should do injustice to thrifty housewives if I failed to mention dried apples, an important article of commerce, and a household necessity when gardens refuse supplies and the markets lack their usual variety.

In country households much care and labor is bestowed in their preparation, all the family frequently taking part; and occasionally the neighbors are invited to a "paring bee," one of the highest forms of social life, for there, without stiffness, formality, costly entertainments, or extravagant equipage, old and young, male and female, educated and ignorant, join in friendly intercourse and useful endeavor.

A few words respecting varieties. Children—all men and women are more or less childish—prefer red apples. The Roxbury Russet is our best keeping apple; it comes in the time of our greatest extremity. Extensive regions that mainly grow their early fruit, depend upon us for their late supplies. The Russet, of Western New York, if properly grown, carefully preserved, and held to the proper time, will give more money than any other apple. It is a hardy tree, and yields abundantly. The Northern Spy is an abundant bearer, but requires a better soil, more pruning and thinning of fruit, and generally does not give so many marketable apples. If people ever become judges of what they eat, they will pay much higher for it in the month of May than for Russets or Baldwins. The Spy is destined to a wider celebrity. The Baldwin gives more fruit per tree fit for market than any other prominent apple, and for the last few years has been more extensively planted. At least nine-tenths of all the apples set in Western New York during the last ten years have been Baldwins and Russets. Nurserymen could not fill their orders for them, and old approved varieties have been re-grafted to these sorts. It is time to inquire whether our markets will be supplied with the requisite varieties when the new orchards have supplanted the old ones.

Every family should have a succession of apples, suited to every season of the year, adapted to different tastes and to various household uses. After apples are mature and ready for use, they soon lose their best qualities. By careful study and arrangement we should provide ourselves with such as are suited to our purpose, and to the time of using them. Few know what a really good apple is. If you call at a farm house you will be served with Spitzenburgs or Russets two months before they are ripe, and insipid Gilliflowers and Seek-no-furthers two months after they

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should have been ended; your distress will scarcely be appeased by the announcement, "We had some good apples, but they are just gone. Most families have good apples only a small part of the year. Those sold in markets are generally kept in warm rooms, and are stale, flat and unprofitable. Apples would be popular as a table fruit, if we could have the best varieties in their best state. What is more delicious than the Early Harvest, the Early Joe, Sweet Bough, Red Astrachan, Maiden's Blush, Fall Pippin, Rambo, Fameuse, Melon, Red Canada, Peck's Pleasant, Swaar, Primate, Spitzenburg, and Northern Spy? Whoever has an acre or two of land should have two trees of each, of those kinds. If he has fifty acres, and does not make a reasonable effort to supply his family and friends with choice fruit, he is open to grave censure. We ought to be willing to raise a few apples for their quality, even if the yield is light. Give them good soil and good cultivation, and the kinds I have just mentioned will supply your table with delicious apples almost the entire year. Baked apples, with, in some cases, the addition of sugar and cream, are a most healthful luxury that we ought to enjoy every day; the apple should be fresh and high-flavored. I would advise to plant largely af the Greening, Twenty Ounce, Wine Apple, Gravenstein, Peck's Pleasant, Wagoner, Talman Sweet, Bailey Sweet, Dutch Pippin, but the larger share should, in deference to the demands of the present market, consist of Russets, Baldwins, and, where they do well, the Northern Spy.

I will not enlarge. The apple, even in its common and unfortunate conditions, is a great popular favorite. We look for it in the background, or foreground of every country residence. Its unparalled productiveness, its healthfulness, its value as food, its high price in the market, its patience under abuse, and its remarkable adaptation to our soil and climate, render it worthy of more extended cultivation and more careful consideration, particularly in Western New York.

The Chairman, Mr. Gould, said, we all feel to thank Mr. Brooks for his admirable address, in which he has presented those points best for farmers to see and profit by. Something, however, had been omitted. He has told us but little of the varities of apples best adapted to our climate or most profitable to be grown, and little of the best methods of culture. Little also had been said about insect enemies, and he hoped other gentlemen would take up these points and thoroughly discuss them. A comparison had been

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made as to the nutritive value of apples and grain. All nutriment was divided into two kinds—carbonaceous, which includes starch, gum and sugar, and the nitrogenous or muscle-building elements. He thought the apple was largely carbonaceous and slightly nitrogenous in its properties as food. He hoped some gentleman would give the relative nutritive value of various kinds of food as compared with apples, that could be grown on an acre. Also, their commercial value, so that it may be demonstrated which is the most profitable crop to be grown. In the town of Malone, a certain man had cleared $40,000 from forty-six acres of hops in one year. Grape culture had proved very remunerative in some localities. On Crooked Lake lands that formerly were worth only $20 per acre, since the introduction of grape culture had increased in value up to $1,200 per acre. Men on the North River also claim great profits in berry and vegetable culture. He hoped these points would be fully discussed.

O. C. Crocker, of Binghamton, did not rise to combat any of the arguments presented by Major Brooks, but to substantiate all that had been said. In order to be successful in apple culture, more pains should be taken in planting orchards. The soil should be dug deep, well pulverized, and, together with the use of lime, would bring the trees earlier into bearing. He would dig the holes where the trees were to be set three or four feet deep, and fill at the bottom with bones, manures and compost. Had been troubled with the borer; had lost a tenth of his trees by this insect, but since using leached ashes had scarcely lost a tree from the borer. He spoke of his visit, this summer, to the fruit growing section of Illinois. There small fruits are grown among the orchards, and the profits are enormous.

Mr. Brooks thought the growing of small fruits in the orchard might be an injury to the trees.

Solon Robinson conceded for three or four counties of the State, all that had been said in favor of the profits of fruit culture, but he wanted to know whether Mr. Brooks' remarks would apply to all sections. He wanted to know whether in New England and in Eastern New York, the orchards were not dying out. Such was the fact, and no art was sufficient to save them. Only here and there was there an orchard that could be said to be healthy. It was not the borers. The trouble commenced at the extremities of the limbs, and it went on until nothing but the stump of the tree was left. Orchards of all ages, once fruitful, are now gone in

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Vermont. It makes no difference whether upon clay or limestone soils. He believed all that was said about the healthfulness of apples as a food, but how can we have them if we cannot grow the trees? Do not know any food better than sweet apples to make pork. In his own orchard he had Newtown pippin trees, thrifty to look at, which had not borne half a dozen pecks of apples in half a dozen years. One of his Rhode Island Greenings, a vigorous tree, never bore a sound apple. Would give $50 to any one who would tell him how to make it bear. It blossoms every year, but does not produce one sound apple. The soil is decomposed granite, with clay. In all orchards there is a deficiency of potash, and that is the reason why ashes make a good manure. Ashes are worth fifty cents per bushel for fruit trees. Believe coal ashes are valuable for orchards and grass. Solid granite or slate rock are valuable also, if ground fine. Do not know the cause of the failure of the apple crop in New England. It is not the cold weather. The sweeping off of timber may have some influence, and would recommend planting timber upon hill tops to serve as shelter. Upon Lake Winepiseogee pear trees grow vigorously, but orchards are dying out. He asked what had killed the peach trees over a wide extent of country? In Connecticut he remembered when the peach trees were so fruitful that the ground under the trees was covered with fruit. Now the trees are all gone; and so in other places. The apples are going in the same way.

Mr. Crocker, of Binghamton, said one of the finest orchards in Broome county, while sheltered, was never known to fail; afterward it was sold, and the timber that served as a shelter cut off, the orchard then began to fail. He recommended plowing about trees. He has an orchard sixty years old that is bearing well. Last year upon the ground I raised a crop of corn, and this year a crop of oats. I plow deep and manure heavily. The trees average from ten to forty bushels to the tree. The orchard was trimmed last year. I trim the top branches and leave the lower branches. Orchards do not fail when well cultivated, in my locality. The poor trees I cut down; they do not pay. My oat crop in the orchard averaged this year one hundred and fifteen bushels to the acre, the oats weighing thirty-five pounds to the bushel.

Mr. Parsons, of Niagara, inquired whether farmers should be encouraged to plant orchards in Western New York? Large tracts have recently been planted with trees; will there be a market for this fruit? Niagara county is famed for its apples and peaches.

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Dealers had recently bought up whole orchards of apples, paying at the rate of $4 per barrel. In 1865, they sold for $5 to $5.50 per barrel. There was a good demand for fruit, and he believed there was no fear of overstocking the market. He could bear testimony to the good effects of cultivating trees well, and instanced two orchards, one of which received good culture, and the other was neglected. The former was worth three times as much as the latter. He spoke of a peach orchard of twelve acres, belonging to John Burdett, on an island in Niagara river, which was cultivated so thoroughly that the whole ground was as mellow as an ash heap, and not a spear of grass was permitted to grow. The trees bore immense crops, and the peaches commanded the highest price in market. Last year he was offered $9,000 for the fruit on the trees, and it brought him over $11,000. It was a question whether we should extend the culture of grapes. A few years since, grapes were scarce. Now grapes are largely cultivated. From this place to Lake Ontario, half a mile from the river, there are many vineyards. The price of the Delaware grape is now from 8c. to 9c. per pound; Concords could be had for 5c. He wanted to know if we can grow grapes at that price. There are thousands of pounds of grapes to be sold here, and the price is low in New York. To be sure, the grapes may be converted into wine, but as a temperance man, he could not advise it.

Mr. Brooks remarked that as yet there was no indication of the apple failing in Western New York. He thought a virgin soil the only soil fit for fruit, and cautioned cultivators against cropping.

Mr. Hawley, of Onondaga county, said that section of the country used to be very favorable for all kinds of fruit—peaches, apples, pears, &c. The peach trees are about gone, and old apple orchards are failing, though under good culture, and only a fourth of a crop is obtained. He has an orchard, set thirteen years ago on sandy soil, seeded the ground to clover and took off three crops and haven't raised a good crop of apples in three years. The trees are thrifty, the ground is rich, being heavily manured, but the apples are wormy. He knew of an orchard in Cortland county which is sheltered on two sides. It bears better than mine, but that, too, is failing. We do not know how to remedy the evil. Mr. H, said there was once a barren tree in his father's orchard. He dug about it and burried near it a dead dog. The next year it commenced bearing and had borne ever since. He spoke of

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another man who had good success in spading around his trees and applying chip dirt.

Solon Robinson said that dead dogs and chips did not save his trees.

John Shattuck, of Chenango county, had paid considerable attention to fruit growing, and his trees are healthy and produce well. He has trees of Baldwins, Greenings and Early Strawberry, which produce abundantly, and can get one dollar a bushel for the fruit. He spoke of orchards in his neighborhood that yielded large crops of fruit, and he attributed their productiveness to the practice of turning hogs into the grounds; they rooted up the soil, and ate up the wormy fruit.

H. Quinby, of Monroe county, has had much experience in apple culture. During the last twenty-five years has planted five different orchards, which have proved thrifty and profitable. He would select good trees. Many purchase trees seven, eight or nine years old; it was a mistake. He preferred trees four years old from the bud, and not stimulated in their growth. Then it was important in taking up a tree properly—was very careful with the young rootlets and to have the roots protected from the sun. It was of the first importance to prepare the ground thoroughly. The hole where the tree is to be planted must be dug large and deep and the soil made rich. Then prune properly, cutting back so as not to have too much top. The ground should be thoroughly cultivated, and no crop grown among the trees, and then an orchard treated after this course would come into bearing in from five to seven years. He went to see an orchard of seven acres in Indiana, and it was loaded down with apples. The owner said he suffered no crop to be grown from the land but apples, and he never failed to raise a crop. The farmers who were trying to grow apples by raising crops among their trees come to him and paid one dollar per bushel for apples. Their trees did not bear. He had an old orchard in which no crop except apples was permitted to grow; the ground was kept well cultivated and for sixteen years had given good crops. His practice is to plant the trees only two inches deeper than the tree grew in the nursery. For Baldwins he recommended the trees to be set two rods apart each way. Had not been successful, he regretted to say, in growing the Northern Spy, the trees did not bear well. The Spy is very objectionable as a shipping apple; considered the Baldwin the most profitable apple for market, though not of the first quality. He

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spoke of a Mr. Rice who got from four acres 600 barrels, which sold for $4,200.

The discussion throughout was animated, and was continued to a late hour, many seeming to regret the motion made for adjournment.

WEDNESDAY EVENING MEETING

The subject for discussion the second evening was "Cutting and Cooking Food for Animals." Hon. A. B. Conger in the Chair.

E. W. Stewart, of Lake View, Erie county, N. Y., opened the discussion. Mr. Stewart said:

The importance of the subject to be discussed this evening, is shown by the fact that more food is required for the domestic animals of the country than to feed our whole population. Anything which will enable us to feed our animals at a less expense or keep more on the same food should be eagerly adopted. The first branch of our subject, "Cutting," has been often discussed and various opinions expressed. Some are afraid that we violate nature in thus preparing food for our animals, as she intended that they should masticate their own food. These forget that when we domesticated animals and fed them upon dry food we changed entirely their habit. In a state of nature animals crop only green succulent, soft food, which requires less mastication than any preparation of cut and steamed food which can be given them. Thus all our efforts in this direction are in imitation of nature, and not in opposition. We cannot cut it too fine, nor steam it too soft, it will still require more mastication than the soft succulent grass. We need improved machines, that will not only cut, but mash the fibre into a pulp. All large horse feeders have discovered the advantages of using cut food in the time saved as well as in the saving of hay. They find that working horses can eat their food in so much less time, that this consideration alone is sufficient to pay all the expense of cutting. "But," say some farmers, "the cows have plenty of time, let them use it to chew their food." Is not that exercise of masticating hard, dry hay and straw an expenditure of force? And that force must be sustained by food and consequently requires more. With fattening animals, we know that they gain faster when we save them that labor. See how much labor a cow must expend to reduce to pulp thirty pounds of hay a day. Can this not be done cheaper by machinery? My experiments have proved that all I can do towards reducing their food to the condition needed for assimilation in the animal's stomach is a saving of the quantity necessary to support the

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animal, and the quality is also improved, so that the animal improves faster. Besides this everything is eaten and saved. The labor of cutting by machinery is not very great. With a two-horse power machine, I can cut hay into one-fourth inch lengths, and feed, with little additional expense to feeding it whole in racks.

HOW FINE SHALL FODDER BE CUT?

In the report of the Department of Agriculture, for 1866, is a valuable article upon "Improved Farm Implements," by S. Edwards Todd. Although an able writer, yet he seems to entertain very erroneous ideas upon the subject of cutting fodder. He says: "In chaffing coarse fodder, it is not necessary to cut the stalks as fine as has been sometimes recommended. Fodder digests much better after being macerated by the teeth of animals than when it is reduced so fine by a straw-cutter that the stock swallow it without first crushing it between their teeth."

We should like to know when and where stalks have been cut "so fine by a straw-cutter that the stock swallow it without first crushing it." If cattle crush even green succulent grass before swallowing it, it is difficult to see how they will be able to swallow dry pieces of stalks without crushing them in mastication. This is all imaginary. Again he says: "The stalks of Indian corn or sorghum should never be cut less than two inches long. When the pieces are longer than the diameter of the stalk, they will always rest on their sides between the teeth of the animal. On the contrary, when the pieces are cut shorter than the diameter of the stalks, the *ends* are presented to the teeth, and the flinty scale will enter the gums almost as readily as a scale of iron or glass." It would appear, from this statement, that he regarded stalks as cut *fine* when the pieces are shorter than the diameter of the stalk. And this may explain the damage he anticipates to the gums of the animal by the sharp flinty scale, but when stalks are cut fine, say one-eighth of an inch long, the hard flinty rind is broken up into shreds, and is much less likely to injure the animal's mouth than when cut two inches long. It is difficult to see how he proposes to make cutting pay the expense, when the stalks are cut so long, for it would lessen the labor of mastication very little. The stalks should be shaved up into thin pieces, not more than one-eighth of an inch thick, and then they are easily macerated by the teeth of the animal.

Again he says: "There is really no advantage in chaffing prime

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hay for animals that chew the cud, while there is profit in cutting it one inch long for those animals that do not chew the cud, such as horses and mules. The advantage arising from chaffing prime hay for horse feed consists in this, that the nourishment is rendered more available by being partially prepared for the stomach by some more effective mechanical means than the teeth. Horses and mules masticate their food before it is received into the stomach more than neat cattle or sheep; therefore there is greater need of coarse fodder being chopped for horses. Neat cattle and sheep chew their fodder but little until it has lain in the first stomach until the hard particles have become quite soft."

Let us examine this argument: 1st. Neat cattle "chew their fodder but little" until after passing into the first stomach, where it becomes soft; therefore there is no advantage in chaffing hay for them. But as they chew their food very little, would it not be well to cut it fine, that it might pass into the first stomach in finer condition, so as to be made still softer before final chewing? For it is well known that any dissolving fluid acts much more rapidly and effectually upon material in a fine state of division than when coarse. But perhaps it will be said that if it be made very fine, there will be no use for this first stomach, and the animal will have no cud to chew. This position will have some plausibility, at least, if it be shown that hay, when cut as fine as any machine will do it, requires less mastication than nature's perfect food, grass. Observe the ruminating animal while cropping the tender herbage, full of juice. How easily it is crushed and reduced to a pulp fit for the first stomach! It must be evident to the careful observer, that succulent herbage, the only food provided for animals in a state of nature, requires less mastication than hay when cut and mashed as fine as machinery can do it. If, then, grass requires preliminary mastication by neat cattle before passing into the first stomach, is it not highly necessary that we assist them in masticating the tough woody fibre of hay, straw and corn stalks, which we, by domesticating, compel them to eat?

2d. Horses masticate their food more than neat cattle; therefore they require it to be "partially prepared for the stomach by machinery, cutting it one inch long." Why one inch long? Why not cut as short, at least, as oats? If it is good to cut it one inch long, why not still better to cut it one-quarter of an inch? As we have shown, it then requires more mastication than grass—the natural food of the horse. To do our full duty to animals, we

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should not only cut but cook their food soft. We have cut fodder through the whole scale, beginning with an inch and a half and coming down to one-eighth of an inch, and have found, practically, that the benefit is in proportion to the fineness of division. We have cut, during the last twelve years, at least five hundred tons of hay, straw and corn stalks, and we know that there is a great advantage in cutting hay for neat cattle, and still more for horses; and that corn stalks, especially, should be cut as fine as possible. The error of all these theorists on cutting fodder is, that they assume hay, straw and coarse fodder to be the natural food of animals, and thus conclude that cutting fine is a violation of their natural habits. It is necessary that they should start with first principles, and then they will see that cutting and mashing the fibre and cooking it soft is only in imitation of nature's green food. When we get machines which will mash or pulp the fodder, the shortness of cut will not be so important. But in purchasing machines, those should be selected which cut the shortest and have the most perfect feed rolls to deliver the hay and straw with regularity to the knives. This is a matter of the greatest importance, and farmers, by discarding all long cutting machines, will stimulate manufacturers to improve them in this respect.

MIXING FOODS.

But there is another important argument in favor of cutting; that it enables the feeder to mix feed of different qualities and value —hay and straw, corn-fodder and hay, pea-straw and hay, good and poor hay, &c.—thus saving all, and many times paying the expense of cutting. And it also renders it easy to mix with it bran, meal, roots, &c., for any purpose desired. I experimented to determine what amount of bran or meal upon straw would make it equal to hay; and found that two quarts of bran or one quart of corn meal upon a bushel of oat, wheat, or barley straw, rendered it equal to the best hay. And, for working horses, this mixing foods is of the highest importance. How many thousands of horses are ruined by feeding too concentrated food, such as cornmeal alone. The philosophy of digestion is not understood or this folly would not occur. When long hay is fed to horses meal must be fed separate. Now, corn meal moistened with saliva or water, goes into the stomach of the horse in the solid condition of the housewife's dough, which she is mixing for bread. To be digested, the gastric juice must penetrate and circulate through this mass of dough. But this cannot be

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done, so this digesting fluid operates only on the surface of the dough. The consequence is, that it cannot be digested before it has produced an unnatural heat and fever in the stomach; causing often congestion and even death. What is called cholic is most frequently produced by such concentrated food. But when the meal is mixed with twice or more its bulk of cut hay or straw, moistened so that the meal adheres to it, this cut hay separates the particles of meal and leaves it so light and loose in the stomach, that the gastric juice circulates through it like sponge. When thus fed cornmeal is perfectly harmless, even to young colts. The only reason why oats are more healthy for a horse than corn, is the fact that oats contain from from twelve to fourteen pounds of husk to the bushel, and, consequently, in eating from eighteen to twenty pounds of oatmeal the horse eats with it from twelve to fourteen pounds of husk to keep it loose in the stomach.

WHAT IS GAINED BY CUTTING FOR A SMALL STOCK.

Now an application of this discovery will show the gain by cutting. When keeping a small stock which would consume thirty tons of hay in a winter, seven tons were sold and seven tons of bran or coarse middlings purchased, for the price of the hay, and used upon straw, and the stock wintered in fine condition. The straw was thus turned into twenty-three tons of hay, worth that year $18 per ton in barn, or $405. And when bran can be purchased at the price of good hay, the avails of one-fourth the quantity of hay requisite to winter a stock of cattle, when invested in bran and used on straw, will enable the farmer to save three-fourths of his hay. Large feeders in England have estimated the gain in nutriment and saving of waste in cutting hay to be equal to twenty-five per cent., and it is my opinion, from long experiment, that half hay and half straw cut fine and mixed intimately together, is as valuable as hay uncut. This certainly shows profit enough in cutting hay and straw. But it is sometimes said it may pay on a small scale, and accordingly many small hand machines are used by farmers to cut for a few cows or a pair of horses, still feeding the principal part of their stock uncut food. Here the ordinary rule of manufacturers is reversed, viz: That what will pay on a small scale will pay much better on a large scale. It costs more in proportion to make one plow than a hundred; so it must cost more in proportion to cut for five cows than fifty or a hundred. All the large omnibus lines and street railroad companies of our cities cut all the

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hay used for their hundreds of horses, because they find, practically that it pays.

COOKING FOOD FOR ANIMALS.

Our first inquiry here should be, what is the effect of cooking food? Starch, as manufactured, or as found in the cells of vegetables, consists of globules or grains contained in a kind of sac, and in order to burst these grains it must be subjected to heat. Payen, on examination with the microscope, found that when starch was mixed with water and heated to 140 deg., some of the smaller grains absorbed water and burst, but many still remained unaffected and only burst between 162 deg. and 212 deg. of heat. This shows conclusively that the heat of the animal stomach is not sufficient to more than partially utilize starchy food. Pereira says: "To render starchy substances digestible, they require to be cooked in order to break or crack the grains." "Starch," says Raspail, "is not actually nutritive to man until it has been boiled or cooked. The heat of the stomach is not sufficient to burst all the grains of the feculent mass, which is subjected to the rapid action of that organ." Brocconot observes that "potatoes employed for feeding cattle should be boiled, since, independently of the accidents which may arise from the use of them in a raw state, a considerable quantity of alimentary matter is lost by the use of these tubers in an unboiled state."

These experiments show the effect of cooking upon grain and roots, but will as favorable results follow cooking hay, straw and coarse fodder?

WHAT IS WOODY FIBRE?—EFFECT OF HEAT UPON IT.

Woody fibre is composed of two parts. First, lignin, which forms the walls of the vegetable cells; and secondly, of cellular fibre (cellulose), which fills the cells and forms an incrustation on their walls. Cellulose has the same composition as starch, gum and sugar. Lignin is but slightly different, containing the same amount of carbon but two proportions less of hydrogen and oxygen or water. Thus all the woody fibre and cellular fiber of our hay, straw and coarse fodder, as well as the trunks of trees, are but slightly different in chemical composition from starch, gum and sugar, which compose the bulk of all our cereal grains. This fact being first determined chemically, we should naturally expect that heat would have a more beneficial effect upon these, than upon starch in our grains, because in the woody fibre it is in a more insoluble

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condition and needs something first to break down its structure. And if woody fibre is chemically the same as starch, then if we can reduce it into a soluble pulp, why should it not be alike nutritious? Let us see what experiments have been made upon this subject. Pereira says, "When woody fibre is comminuted and reduced by artificial processes, it is said to form a substance analogous to the amyloceous (starchy) principle and to be highly nutritious." Schubler states that "when wood is deprived of everything soluble, reduced to powder, subjected to the heat of an oven, and then ground in the manner of corn, it yields, boiled with water, a flour which forms a jelly like that of wheat starch, and when fermented with leaven makes a perfectly uniform and spongy bread."

Johnston says, speaking of these experiments: "Woody fibre may be changed into starch thus by the unaided action of heat, and the starch thus produced changed, first into gum, then into grape sugar, by the action of dilute sulphuric acid, assisted by a moderate heat." Tomlinson, in his Cyclopedia, asserts that in Norway and Sweden sawdust is sometimes converted into bread for the people by a similar process; and the newspapers have stated, lately, that Norway was reduced to the necessity of using sawdust bread. So we see that woody fibre, practically as well as theoretically, is nutritious, and that heat will develop this nutriment. Heat will develop it into starch, and the action of an acid is necessary to turn it into sugar. The gastric juice supplies this acid, and after the proper application of heat, can dissolve woody fibre or starch, and probably convert it into sugar before it becomes nutritious. Starch is an element of respiration, and supplies animal heat, and, according to Liebig, the surplus contributes to the formation of fat in animals. The heat of the animal stomach is sufficient to dissolve and appropriate to the use of the animal a portion of the nutriment of grains and woody fibre used as food; but there can be no doubt that a large percentage is wasted for the want of a higher degree of heat. But the question may be asked: Can woody fibre in hay, straw and coarse fodder be reduced, economically, to such a pulp as to be nutritious to our animals? All woody fibre will yield to steam pressure—straw to one hundred and thirty pounds to the square inch, and even chips, of the trunks of trees, to two hundred pounds. This reduces straw and wood to a uniform pulpy mass, and after being bleached, makes white paper. And it is highly probable that even the trunks of trees, when so reduced, are nutritious. All

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settlers, in a new wooded country, know that animals, when driven to the necessity, can live on the twigs of fallen trees. These twigs are tender, and can be partially reduced by mastication, but steam pressure will reduce the hard grains of the wood more perfectly than any possible mastication of the twigs by the animal. It will not be necessary to use so great pressure to render the fibre of straw nutritious to animals as to fit it for paper; but those experiments in making straw paper teach us that it is much better to steam under pressure than without pressure. The heat of steam is in proportion to its pressure, and it is this great heat which gives it its dissolving power.

Practically, thirty pounds to the inch will reduce the fibre of hay, straw, &c., to such a pulp as will enable the animal to utilize all its nutriment; and this degree of heat may easily be obtained with an iron steam box to hold the pressure. The price of iron is rapidly declining, and very soon an apparatus with an iron steam box will be within the means of all farmers keeping ordinary stock.

DOES IT PAY TO COOK FOOD.

This is the all-important question; for if it does not pay a balance over the expense, then no profit can accrue from its practice. After eleven years in cooking this winter food for my animals, I can say that the advantages are all that theory would indicate. Steaming renders mouldy hay, straw, and cornstalks sweet and palatable, thus restoring their value; renders peas and beans agreeable food for horses as well as other stock, and thus enables the feeder to combine more nitrogenous food in the diet of his animals. We have found half hay and half straw mixed and steamed more than equal to hay unsteamed. Pea straw when cooked is readily eaten, and if cut early, nearly as nutritious as hay. Bean straw, which when dry, is generally left untouched by cattle, will be all eaten if steamed with hay, and, as analysis shows, is more than equal in flesh-forming matter to hay. Corn stalks, when cut and steamed, will be eaten clean by cattle, horses, and sheep. By cutting and cooking, all the straw and coarse fodder raised on the farm may be turned into milk, flesh, and wool, besides adding largely to the manure heap. In cities, where cows are kept to supply milk, and are milked through the winter, cooking their food will greatly increase the yield of milk, improve the condition of the cow, and reduce the expense of keeping, at least one-third. The saving in food for each cow in milk will be, at least, eight dollars per season. This item may be worth looking after by city feeders.

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SIXTEEN POUNDS OF COOKED FOOD FOR A COW.

A mixture of oil and pea meal and bran, makes an excellent food to produce milk, and keep up the condition of the cow. One and a half pounds of oil and pea meal, and three pounds of bran mixed with ten pounds of hay and steamed, per day for each cow weighing 800 pounds, will generally be sufficient. This has been determined by my experiments, long and faithfully tried. This may be thought a small quantity, from which a cow of that size at her best season, could produce four gallons of milk and keep up her condition; but it must be remembered that four gallons of milk contain only about four pounds of dry matter, which will leave a supply for the thrift of the cow. And when this sixteen pounds of hay, oil and pea meal and bran are thoroughly cooked together, the nutriment is all extracted by the animal. Eight pounds of butter per week from a cow, in January, has been produced in my stable from this amount of feed carefully weighed. Yet it is always the best economy to give a cow, in milk, all she will eat with a good appetite; for it takes a certain quantity to keep the cow in condition without giving any milk, and what she will eat and properly digest, above this, should go to the production of milk. The profit always comes from the extra food. It was proved in this case, that when these same cows were given the same quantity and quality of food uncooked, the yield of butter was a little less than five pounds per week. And this result is accounted for in the probable fact, that when uncooked, this amount of food was insufficient. The cows fell off in flesh. On adding eight pounds more of this food in the same proportions, all uncooked, the product of butter was nine pounds per week. Then I changed them back to cooked food, and added one-half pound each of pea and oil meal and one pound of bran, making in all eighteen pounds—ten pounds of hay and eight pounds of pea, oil meal and bran. The second week of this latter experiment, the product of butter was ten pounds per week; showing that the addition of two pounds per day of oil, pea meal and bran, produced two pounds of butter per week. This is important, as showing that additional feed may be given with a profit. This extra food, calculated at the present high prices, would be but twenty-eight cents per week, and the product is worth eighty cents. The material from which the cow elaborates the casein and oil of the milk, is comparatively much cheaper than the product in butter and cheese. The casein in the raw food is worth only eight cents per pound at these enormous rates while the casein in the form of cheese is worth

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sixteen cents per pound. The oil or butter in the raw food is worth only fourteen cents per pound, while the product in butter is worth forty cents. Farmers should remember that scanty feeding is always done at a loss. No profit accrues till the animal has a surplus above the wants of its own system; and, consequently, if the animal be barely sustained in its condition without producing milk or laying on fat, then the entire food consumed is lost, except when the season approaching renders the animal of more value. These to my mind, were a conclusive test of the value of cooking food. And based upon these experiments and others, I have stated that sixteen pounds of hay cut and steamed, is equal to twenty-four pounds unsteamed. This I believe to be a moderate statement, and fully borne out by the facts.

Another important experiment was tried while fattening twenty head of steers of about the same weight, ten head standing on each side of the floor. Each ten head were getting three bushels of cornmeal per day which they easily consumed. Then we took a bushel and a half of meal, made it into a thin pudding, stirred in six bushels of short cut hay, and cooked it all thoroughly in a large kettle, and fed this amount daily to ten steers, with what other hay they would eat, for two weeks. This seemed to satisfy them even better than the three bushels of uncooked meal, and they appeared to gain faster. This same amount was cooked and fed to them until turned to the butcher, while the other ten were fed three bushels of uncooked meal, and all sold to the same man, and those fed on half the quantity of cooked meal were pronounced the best steers. This last experiment demonstrates that cornmeal is doubled in value by cooking. But this experiment with cornmeal is fully borne out by the statements of others:

Mr. Mason, of New Jersey, found that pork fed upon raw corn cost twelve and a half cents per pound, and that from cooked corn four and a half cents. James Buckingham, as detailed in the *Prairie Farmer*, found that a hog fed on one and three-foourths bushel of raw meal gained nineteen pounds, and another fed one bushel of cooked meal gained twenty-two pounds.

COST OF COOKING.

Next let us see what it costs to cook food, that we may determine whether it pays. When cooking for forty-eight head of cattle and six horses, I found that it took two men and a boy, on the average, two and a half hours per day to cut, mix and steam food for them. I found that the labor, including the feeding, was equal

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to ten hours per day for one man. After the food is cooked the labor of feeding is less than in the ordinary way. It took ten cords of two feet, or five cords of four feet, hemlock wood, to steam for the season, worth about $20. I found the extra expense of labor, over common feeding, $60, and added to the wood makes $80 as the whole extra expense. The amount saved could not have been less than $10 per head or $540. The saving in amount of food alone, would equal this, besides being able to use much coarse fodder, that would otherwise have been wasted.

EFFECT OF COOKED FOOD UPON ANIMALS.

It has sometimes been urged that although the animal eats less and for a time thrives better upon cooked food, yet its tendency is to weaken the stamina of the system and produces premature decay. I have been able to test this theory fairly, and can now show as the result, cows and horses which have been fed every winter upon cooked food for eleven years, and so far from showing any ill effects of this way of feeding, the cows have never been sick, and are now in fine condition and heart, and the horses able to do good work, although sixteen and seventeen years old. I have raised many colts from weaning age to five years on cooked food, winters, and never saw any want of stamina. The effect of cooked food upon horses with a cough or sudden cold is very remarkable, generally producing a cure in a few days. It will cure incipient heaves, correct costiveness, and materially improve a founder. In fact, my animals have been more uniformly healthy since feeding them upon cooked food; and this, probably, is explained by the fact that cooked food more nearly resembles the natural food of animals, succulent grass. Who ever supposed that a good pasture would injure the stamina of colts and calves? Horses, whose constitutions have been injured by hard work and unground grain, are taken to the pasture and turned out to rest and recover their stamina again.

I have one small horse used for the buggy that is now twenty years old, and which ten years ago was thought to have the heaves, but on putting him upon steamed food, every trace of it disappeared, and when, since he has been imprudently driven and taken cold, a few days of steamed food cures him. My oldest team, which I have used from colts, have done much heavy labor, and from having a multiplicity of drivers have not always been used well, have often taken sudden colds, and contracted in the fall a severe cough, but on being put upon steamed food, the cough and its effects have soon ceased. I am thoroughly satisfied that horses will live longer and perform much more service kept upon cooked food.

But it is true that sheep and other animals fattened rapidly

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upon steamed food will be softer in flesh than if fattened more slowly upon uncooked food. Yet this would naturally be expected. Grass grown rapidly upon very rich land is not so solid as that grown slowly upon poorer land; but who would prefer the poorer land in consequence? I have found no difficulty in correcting this. Just before animals are ready for the butcher, feed them a few days upon dry, uncooked food, which will correct this softness of flesh.

PREPARING FOOD FOR STEAMING.

The cut hay, straw and hay, or other cut feed is moistened with a large watering pot (if done by hand), at the rate of at least three gallons of water to five bushels of feed, while it is being stirred up with a fork; then if bran, meal or other more concentrated food is used with it, it should be sifted on and evenly mixed. Two quarts of bran to the bushel of straw will render wheat, barley, oat and pea straw equal to good timothy hay. A little salt should be added, which will be perfectly diffused through the mass. The feed must always be moistened before steaming, for steam will not cook dry hay or straw, but only dry it more, and if the steam is very hot, it will char or burn it. Moisture is required to absorb the steam. Many failures have occurred from attempting to steam cut hay or straw dry. Where the labor is done by hand, a square six bushel basket will be found the most convenient for handling the cut feed aud filling the steam box.

COMPARATIVE VALUE OF HAY, STRAW, COARSE FODDER AND GRAIN.

Few farmers have acquainted themselves with the comparative value of different kinds of food. Straw and coarse fodder are held in little esteem, and mostly go to waste; and it seems appropriate that I should here give as complete an analysis of the various kinds of food used for animals as can be found. This table will greatly assist the intelligent farmer in selecting the food of his animals, and also in using, profitably, much that is now wasted.

AVERAGE COMPOSITION OF THE GRASSES.

	(PROF. WAY.) White Clover.	(PROF. WAY.) Red Clover.	(PROF. WAY.) Timothy.
Flesh formers	15.50	18.00	10 00
Fat formers	3.40	3.00	3.00
Heat producers	35.31	37.00	44.60
Woody fibre	25.00	21.84	26.05
Mineral matter	8.79	8.06	4.35
Water	12.00	12.00	12.00
	100.00	100.00	100.00

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	(PROF. WAY.) Blue grass.	(PROF. WAY.) Orchard grass.	Red top.
Flesh formers	9.11	1.91	10.01
Fat formers	2.31	2.77	3.00
Heat producers	37.90	39.01	32.00
Woody fibre	33.47	29.63	35.41
Mineral matter	5.21	4.68	7.58
Water	12.00	12.00	12.00
	100.00	100.00	100.00

	(CYC. AG.) Wheat straw.	(JOHNSTON.) Rye straw.	(JOHNSTON.) Barley straw.
Flesh formers	1.81	1.50	2.10
Fat formers	.71	.50	.90
Heat producers	30.15	38.00	30.00
Woody fibre	50.03	45.00	50.00
Mineral matter	5.30	3.00	5.00
Water	12.00	12.00	12.00
	100.00	100.00	100.00

	(JOHNSTON.) Pea straw.	(CAMERON.) Oat straw.
Flesh formers	12.00	4.50
Fat formers	1.50	1.84
Heat producers	44.50	40.00
Woody fibre	25.00	37.42
Mineral matter	5.00	4.24
Water	12.00	12.00
	100.00	100.00

	(J. H. SALISBURY.) Corn fodder.	(PROF. WAY.) Bean straw.
Flesh-forming matter	8.200	16.38
Heat and fat-producing matter	35.273	33.86
Woody fibre	50.257	25.84
Mineral matter	.....	9.45
Water	6.276	14.47
	100.000	100.00

These analyses were nearly all made when the grasses were just coming into blossom, and the grain in the dough state, so that they contained the greatest amount of nutriment. The grasses when fully ripe, and the straw from grain fully ripe, will show much less soluble matter, and therefore so much less nutriment. This should always be borne in mind by the farmer in cutting his grain and grass; but it is highly probable that much of the insoluble fibre of over-ripe straw and hay will become soluble when steamed under pressure. It will be noticed on examining the analysis of straw that

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many of them have relatively much more nutriment when compared with hay than is generally supposed. Pea straw, when cut while the pea is soft, is quite equal to hay, especially when the stalk is softened by steaming. Corn fodder, as appears by Mr. Salisbury's analysis, is quite equal to over ripe hay. This sample was taken while the ear was soft. Bean straw appears to be quite equal to good hay, but as it is generally obtained, it would be far inferior to this sample. Usually, it is found so hard and tough that animals will not eat it; but steaming renders it soft and palatable. To show the value of oat straw as compared with oil meal, we will give the statement of C. A. Cameron, of Ireland: "Assuming that one hundred parts of oat straw contain, on an average, one part of oil, four parts of flesh formers, ten parts of sugar, gum and other fat formers, and thirty parts of digestible fibre, and that the price of straw is $7.50 per ton (the average price in Ireland), we have at that cost the following quantities of digestible substances:

ONE TON OF OAT STRAW, AT $7.50.

Oil	22.4	pounds.
Flesh-forming principles	89.6	"
Sugar, gum and other fat-forming substance	224.	"
Digestible fibre	672.	"
Total amount of fat formers	1008.	"
Calculated as starch	952.	"
Add flesh formers	89.6	"
Total amount of nutritive matter	1041.6	"

A fair sample of linseed cake contains twenty-six parts of flesh formers, twelve parts of oil, thirty-four of gum, mucilage, sugar, etc., and six parts of woody fibre and costs $55 per ton.

ONE TON OF LINSEED CAKE, AT $55 PER TON.

Flesh-forming principles	582.4	pounds.
Oil	268.8	"
Gum, sugar and other fat formers	761.6	"
Woody fibre	74.4	"
	1687.2	
Total amount of fat formers calculated as starch	1508.	pounds.
Add flesh formers	582.4	"
Total amount of nutriment	2090.4	

These comparisons show that 2,000 pounds of nutriment in linseed cake cost $55; whereas, $7.50 invested in oat-straw, gives 1,000 pounds of digestible aliment, and it is believed that when

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the latter article is cut in proper season and well harvested, its composition will be found superior to that given in the comparative analysis. Digestion is promoted by mixing with straw a due proportion of oily or fatty matter. Straw is, also, relatively deficient in flesh forming principle, and abounds in heat and fat producing elements, of which, however, the most valuable (oil) is the least abundant. Now if we add to the straw a due proportion of some substance very rich in flesh formers and oil, the compound will possess in nicely adjusted proportions, all the elements of nutrition." Although the foregoing comparison was made for Ireland, it is equally instructive to us. Straw here is, generally held in less value than in Ireland. Of course, straw is not a perfect food alone, but as far as it can be used is the cheapest food.

We will now give a table of the more concentrated aliments—the grains, &c.

Indian Corn and Wheat Bran.

	(Salisbury.) Indian corn.	Wheat bran.
Flesh-forming matter	15.192	18.00
Heat producing	78.866	63.00
Fat	5.945	6.00
Water	.....	13.00
	100.000	100.00

Oats and Rye.

	(Emmons.) Oats.	Johnston.) Rye.
Flesh-forming matter	18.447	16.00
Heat-producing matter	73.376	69.00
Fat-producing matter	7.178	.....
Soluble phosphates	.....	3.06
Water	.....	11.04
	100.002	99.10

Beans and Peas.

	Beans.	Peas.
Legunim, albumen, or flesh formers	23.6	26.4
Starch	43.0	43.6
Sugar	0.2	2.0
Gum, &c	1.5	4.0
Oil and fat	0.7	1.2
Husk	7.0	8.3
Salts and loss	1.0	2.0
Water	23.C	12.5
	100.00	100.0

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It will be noticed that wheat bran has more muscle-forming matter than Indian corn; and that from the analysis, it is as valuable for all purposes except fattening as corn meal. From long experience we have found wheat bran equal to the analysis.

When well steamed, it is worth as much per weight as Indian meal. The analysis of peas should be studied. Pea-meal has not been, generally, appreciated at its true value. From the large proportion (26 per cent.) of flesh formers, it should be used by every dairy-man who can obtain it, at a reasonable price, to supply the casein in the milk and keep up the flesh of the cow. It is also rich in the phosphates, upon which the cow so largely depends. A critical examination of these analyses, will show the farmers, readily, how to mix a proper food to build up all parts of the animal system.

ANALYSIS OF ROOTS USED AS FOOD FOR STOCK.

These analyses will be imperfect without a statement of the nutritive value of the carrot, beet, parsnip and turnips, which should form an element of winter food for animals wherever they can be economically raised.

	Carrot.	Parsnip.	Swedish Turnip.
Flesh formers	.6	1.2	.8
Heat and fat-producers	7.6	7.7	6.0
Woody fibre	3.3	8.0	2.5
Mineral matter	1.0	1.0	.9
Water	87.5	82.1	89.8
	100.0	100.0	100.0

MANGOLD WURZEL BEETS.

	Long red.	Short red.	Orange Globe.
Flesh formers	.48	.44	.40
Heat and fat-producers	10.46	11.96	10.24
Woody fibre	3.08	3.31	2.88
Ash	1.00	1.02	1.00
Water	84.98	83.27	85.48
	100.00	100.00	100.00

These roots have a feeding value beyond what appears in the analysis. They all contain pectic acid, which assists in the digestion of other food. It is found that a horse will perform as much service and keep up his flesh as well, by substituting carrots for one third of his oats. The carrots assist in the more perfect digestion and assimilation of the oats. Pectic acid is supposed to have the power to gelatinize the contents of the stomach. And as

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grains, when fed in the ordinary way are not all digested, as may be seen by the most cursory examination of the manure of the horse, these roots are very valuable, fed in connection with other food. The analysis shows that they are deficient in muscle forming matter, and therefore should be used with more nitrogenous food. These roots are excellent, when sliced into thin pieces, to mix with hay and straw before steaming. They give an agreeable flavor and odor to the whole mass.

APPARATUS.

Where steaming is done without pressure and through a steam pipe, a wooden steam-box answers every purpose, and this is the only box I have yet used. This is best made in the form of a cask, with staves inch and a half thick and hooped with strong iron. It is better to make it slightly tapering towards the top, so the hoops will not get loose. Where a large stock is to be kept, perhaps the best apparatus other than a steam engine for cooking food, is a wrought iron hollow cylinder, one-eighth of an inch thick, thirty inches in diameter and four to six feet long, with quarter inch iron heads, a hand hole in front end to clean it out, secured by iron stopper with rubber packing; also a stop cock in this end from which to draw hot water; a one inch steam-pipe coupled to the top of the boiler, reaching over the brick arch down to the bottom of the steam-box, entering the side near the centre; also a short pipe on top with a stop cock, through which to fill the boiler with a tunnel or by a force pump; it should be filled a little more than half full of water. The boiler must be set in a brick arch, raised sixteen inches above the fire-bed or grate, walls twenty-two inches apart. The fire is conducted under the length of the boiler, raised a few inches at the back end, then carried along each side to within four inches of the front end, in a flue, and back in another above this to the chimney. This leaves the front end of the boiler exposed. There should be a three-sixteenths iron front to receive the end of the boiler, in which are the doors for fuel and ash pit. The six feet boiler will have a capacity to cook food for any number of animals up to two hundred, and will cost including front, grate, steam-pipe, all complete $100. Steam box should be made as above directed, and of such size that it will hold one or two days feed for stock, with a close fitting cover held down by a shore. A strip of rubber may be put on upper end of box and make it nearly steam-tight.

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A CHEAP STEAMER.

For a small stock a cheap arrangement may be got up by setting a caldron kettle in a brick arch, with a flue leading under and around the kettle into a chimney. A linseed oil cask or other strong tub may be set on top of the kettle and filled to the rim and a strip of rubber put on the rim to make it tight. The upper end should be sawed around close to the hoop, as this end may be taken off in filling and put on again. A two inch hole may be bored through the centre of the bottom, through which to fill the kettle and then stopped with a plug, and also numerous small quarter inch holes through which the steam may come up. The box should be held down with a shore. This will work well if water is always kept in the kettle.

ANOTHER CHEAP STEAMER.

The objection to this steam caldron is; that potatoes or other roots, and hay, will exude juice, which will drip slowly down into the kettle and burn on the bottom. This will require frequent cleaning of the kettle, and, of course, the tub or box must be taken off, which will add to the labor. This same objection applies also to the next apparatus described, but not in the same degree, as the false bottom is easily taken out, the fire bottom cleansed and then replaced.

We are so anxious to see cooking, in some form, introduced generally among farmers, that we have described these cheap apparatus for the benefit of those who think they are not able to purchase any other.

We will next give a description of a very simple apparatus, which is within the reach of every farmer. It is described, without the improvement, which should be made to it, in the Transactions of the American Institute for 1863. "Get a sheet of No. 18 iron, (No. 16 would be better,) thirty-two to thirty-six inches wide, and seven or eight feet long (or two sheets may be riveted together, and thus make one fourteen feet long, if much work is to be done.) Take two inch pine plank (maple would be better) about two feet wide; let the side extend three inches past the end plank; make a box a little flaring at the top and wide and long enough, so that the bottom sheet will cover and project half an inch on each side and end. Let the ends into the sides one-fourth to three-eights of an inch in making the box, and put it together with white lead and oil, and put two three-eighth inch iron rods through the sides at each end, outside of the end plank; then nail on the bottom sheet with

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two rows of five-penny nails, the nails about an inch apart in the rows, and breaking joints, and bend up the sheet where it projects." This will hold some thirty bushels. "Now take flat stones or bricks, and make a fire-place the length of your box, and eight inches narrower on the inside than your box is wide on the outside." Fire bed should be sixteen or eighteen inches deep. "Put across, at each end, a flat bar of iron one half by one and a half inch, so as to lay a row of bricks on these for the ends of the box to rest on, and at the back end let the arch run out so as to build a small chimney, and put on some joints of stove pipe, and you have a cooking apparatus."

This is a good boiling arrangement, where only water or some thin liquid is to be heated; but if hay or straw, or even potatoes, are to be boiled with little water, as would be the case, especially in steaming fodder, it would settle and burn on the bottom. We have many times tried this in a large kettle, with this result. This difficulty can be obviated entirely, and a good steaming apparatus be made of it by placing a false bottom one inch above the real bottom. This may be done in the following manner: Take a sheet of No. 18 iron, of the size of the box, or, perhaps, one-half inch wider; have this punched with small holes, so as to let the water down and the steam up. It can be let into the side of the box, or a half inch cleat can be nailed on the side and end of the box for it to rest on. This would not sufficiently support the weight of feed put on it, and, therefore, three-eighth inch rods must be put through the sides, under this false bottom, to sustain it—one, perhaps every foot. Then a wooden or iron faucet must be put through the side between these bottoms, to draw off the water. This false bottom may more cheaply be made of wood three-fourths of an inch thick and bored with three-sixteenth inch holes to let up the steam, and instead of the rods on which to lay it, place strips of wood across the bottom to support it. These wooden strips will not burn, being in water. This wooden false bottom will be as effectual as the iron; but care must be taken to always keep water in it.

Now, with a wooden cover fitted tight on top of this box, you have as good a steaming apparatus, without pressure, as can be desired. But it would not be as safe as to fire, near a building, as the steam boiler set in arch, because in that the forward and return flues, on the sides of the boiler effectually extinguish sparks. Yet a spark extinguisher may be placed in the chimney and render it

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safe. The chimney should be about two feet longer than the steam box to make a proper draft. This apparatus would probably, cost from $25 to $50, and the largest size would be ample for fifty head of cattle.

A PORTABLE STEAMER.

D. R. Prindle has got up the best portable caldron and steamer, which affords all the pressure needed, and to which you have only to attach a steam-box. It is also exceedingly convenient for boiling clothes, making soap, and various other purposes on a farm.

ARRANGEMENT FOR A LARGE STOCK.

For the benefit of those who wish to feed a large stock of seventy-five to two hundred head of cattle or more, I will suggest an arrangement which will save much labor, economize the material and produce more uniform results.

A portable steam engine of five horse power provided, we will arrange the animals, engine, steam-box, food, etc., as follows: The stables are in the lower or basement story, on each side of a feeding floor ten or twelve feet wide. It would also be very convenient to have room behind each tier of animals to pass a cart or wagon to carry off the manure, instead of throwing it out at the side. A wooden track should be laid in the centre of the feeding floor on which to run the steam-boxes. Two strongly made tubs, holding 250 bushels each, should be provided for one hundred head of cattle. One would be run under the upper floor to be filled and steamed and then moved away for use, while the other could be run to the spot filled and steamed. But with this number of animals to feed, an iron steam-box should be provided instead of wood so that the feed may be steamed under pressure. This may be a three-sixteenth iron cylinder, six feet in diameter and five feet long, with heads cone-shaped down to an oval twenty-four by thirty inches in diameter, for a man-hole, which should be covered by a man-hole plate in the ordinary way. This should be placed under the upper floor erect, so as to receive the food from above through the upper man-hole before steaming, and the lower to discharge it after steaming. The feed should be rammed hard into the box, and a hook used to loosen it at the lower end when discharging. It should be elevated on a frame so far from the floor, say three feet, as to allow a box on wheels to be run under it to receive the contents after steaming, and be run off on the track for use. This steam-box would hold about one hundred and twenty-seven bushels, and two boxes would be sufficient for a day's

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feed of one hundred head of cattle. Mr. F. Jay Bruce, of Madison county, has proposed to me an improvement on this arrangement of iron steam-box, which consists in hanging it on trunions in the centre and have the steam-pipe introduced through the trunion, with no man-hole at the lower end, but a plate riveted on instead, and when the steaming is finished revolve the steam-box, upper end down, on the trunions and let it discharge from the upper end, and when turned up again, it is ready for refilling. This is certainly an ingenious arrangement saving the trouble of the lower man-hole, and, probably, would not be more expensive. I think this arrangement of steam-box better than the one given above.

On the upper floor the straw-cutter will be placed, provided with a feeding apron, with two bins overhead, one for cut hay or straw, the other for meal or bran. Elevators to carry up the cut feed from the straw-cutter to the feed bin, as fast as cut, would be necessary.

There would also be necessary a water pipe connected with an elevated reservoir, to furnish water to moisten the feed. A tank might be placed overhead and filled with a force-pump. Then, in a scuttle through the floor directly over the steam-box, there will be placed a straight cask or cylinder, two feet in diameter and two or three feet long, without a bottom, but a bar across the lower end, on which an upright revolving shaft will be set in the center, provided with six arms just long enough to turn inside. This shaft will pass through a like cross bar on top and extending above enough to receive a pulley of the proper size to revolve it five or six hundred times per minute. Now a large spout will extend from the elevated feed bin to the top of this cylinder, with a slide to open and shut it; also a spout extending from the meal or bran bin, so as to communicate in the same way with the cylinder, and a water pipe, also, furnished with a stop-cock; and a moveable cover placed on top of the cylinder. A belt will run from the engine to the pulley on top of this shaft. Now, when ready to fill the steam-box, this shaft will be set in motion, the spout for cut feed will be opened so as to discharge a definite quantity, the spout for meal opened to discharge the quantity desired, and the water so as to let in at least three gallons for five bushels of feed. It will be seen that the feed, and meal and water, in passing through the cylinder, will come in contact with three swift-moving arms on the shaft, and being thoroughly mixed, fall into the steam-box ready for steaming, the feed should be pressed into the steam-

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box, as more will be steamed and better. Mr. Bruce suggested that instead of elevating the cut hay or straw into a bin, which, perhaps, would clog in the spout in drawing down again, the straw-cutter might be placed so that the cut hay or straw would fall directly into the cylinder for mixing, and the meal or bran and water could be properly proportioned to the hay as cut, and thereby save some expense of the arrangement and labor of elevating. This latter suggestion may work in practice, and, if so, will somewhat simplify the operation. The engine should be placed as near the steam-box as practicable. It may be placed in the stable and communicate with a chimney outside, rendered secure from fire by spark-extinguishers and laying brick or stone around the fire entrance. A belt can be run through the floor to connect with the straw-cutter.

With this arrangement one expert man can cut and steam feed for one hundred head of cattle, and two men could easily care for two hundred. It will be seen that with proper system and machinery, the expense for cutting and steaming for a large stock will be little more than in the ordinary way of feeding. This steam engine may be used to grind and thresh the grain, cut and steam the feed, saw the wood, and do all the work requiring stationary power on the farm.

RECAPITULATION.

It now remains for us to give a summary of the results of cooking by the method detailed. *First*—It renders mouldy hay, straw, and cornstalks, perfectly sweet and palatable. Animals seem to relish straw taken from a stack which has been wet and badly damaged, for ordinary use; and even in any condition, except "dry rot," steaming will restore its sweetness. When keeping a large stock, we have often purchased stacks of straw which would have been worthless for feeding in the ordinary way, and have been able to detect no difference after steaming, in the smell or the relish with which it was eaten.

Second—It diffuses the odor of the bran, corn meal, oil meal, carrots, or whatever is mixed with the feed, through the whole mass; and thus it may cheaply be flavored to suit the animal.

Third—It softens the tough fibre of the dry cornstalk, rye straw, and other hard material, rendering it almost like green succulent food, and easily masticated and digested by the animal.

Fourth—It renders beans and peas agreeable food to horses as

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well as other animals, and thus enables the feeder to combine more nitrogenous food in their diet.

Fifth—It enables the feeder to turn everything raised into food for his stock, without lessening the value of his manure. Indeed, the manure made from steamed food decomposes more readily, and is therefore more valuable when used in a fresh state. Manure made from steamed food is always ready for use, and is regarded by those who have used it as much more valuable, for the same bulk, than that made from uncooked food.

Sixth—We have found it to cure incipient heaves in horses, and horses having a cough for several months at pasture have been cured in two weeks on steamed feed. It has a remarkable effect on horses with a sudden cold, and in constipation. Horses fed upon it seem much less liable to disease; in fact, in this respect, it seems to have all the good qualities of grass, the natural food of animals.

Seventh—It produces a marked difference in the appearance of the animal, at once, causing the coat to become smooth and of a brighter color, regulates the digestion, makes the animal more contented and satisfied, enables fattening stock to eat their food with less labor (and consequently requires less to keep up the animal heat), gives working animals time to eat all that is necessary for them in the intervals of labor; and this is of much importance, especially with horses. It also enables the feeder to fatten animals in one-third less time.

Eighth—It saves at least one-third of the food. We have found two bushels of cut and cooked hay to satisfy cows as well as three bushels of uncooked hay, and the manure in the case of the uncooked hay contained much more fibrous matter, unutilized by the animal. This is more particularly the case with horses.

These have been the general results of our practice, and, we presume, do not materially differ from those of others who have given cooked food a fair trial.

OPINIONS OF AMERICAN AND ENGLISH FARMERS.

George A. Moore, at the New York State Fair discussion, 1864, says: "I was feeding sheep and cutting for them timothy hay, millet, carrots, and feeding with bean and oat meal. Before steaming, I found, by weighing, I was putting on two pounds of flesh per week. After steaming, I put on three pounds per week, and the stock eat the food cleaner, and I noticed they laid down quietly after feeding. I also experimented with sixty-four cows. Used

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one of Prindle's steamers; had a quantity of musty hay which I cut and steamed. They would eat it entirely up, and seemed better satisfied with it than the sweetest, unsteamed hay. Steamed food does not constipate the animal—the hair looks better. I think cutting and steaming combined insure a gain to the feeder of at least thirty-three per cent. The manure resulting from feeding steamed food is worth double that from feeding in the ordinary way. Have kept eighty head of stock, and had a surplus of food on a farm where, previously, only fifty were carried through, and hay bought at that. After cows come in, steamed food increases the milk one-third, and the cows do better when put out to grass."

George Geddes, in the same discussion, says: "I find if I take ten bushels of meal and wet it in cold water, and feed twenty-five hogs with it, that they eat it well; but if I take the same and cook it, it will take the same number of hogs twice as long to eat it up, and I think they fatten quite as fast in the same length of time. By cooking, you double the bulk."

Hon. A. B. Conger, Ex-President of the New York State Agricultural Society, said at same discussion: "But steaming alone is not sufficient in the preparation of the food. It must be first wet, so that if left alone ten hours it will heat. Water in large proportion must be added to the hay or straw after cutting; and so prepared and steamed, thirty head of stock may be kept on the same amount of food as twenty on unprepared food. The mistake made in the early experiments in this country and England was, that the food was not sufficiently wet before steaming."

Professor Mapes says, Transactions American Institute, 1854, page 373: "Raw food is not in condition to be appropriated to the tissue of animal life. The experiment, often tried, has proved that eighteen or nineteen pounds of cooked corn is equal to fifty pounds of raw corn for hog feed.

Mr. Mason, of New Jersey, found that pork fed with raw grain cost twelve and a half cents a pound, and that from cooked food four and a half cents. Cooked cornstalks are as soft and almost as nutritive as green stalks. Cooking is an improvement that pays. Cattle can be fattened at about half the expense upon cooked food, in a warm stable, that others can out doors upon raw food."

S. H. Clay, of Kentucky, says: "Fed two hogs on uncooked corn in thirty days, 405 pounds, and they gained forty-two pounds; while two hogs fed on cooked corn meal for thirty days ate 270 pounds, and gained eighty pounds. The food was then reversed,

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and the two hogs that had previously had dry corn, were fed on cooked meal. In twenty-six days the two hogs that were fed on dry food ate 364 pounds of shelled corn, and gained forty-four pounds; while the two hogs fed on cooked meal ate, during the same time, only 234 pounds, and gained seventy-four pounds." Here it appears that a bushel of raw corn makes five and three-quarter pounds of pork, while a bushel of cooked meal makes seventeen and a half pounds.

James Buckingham gives, in the Prairie Farmer, an experiment with cooked corn meal, corn in the ear, and raw meal. He put three hogs into separate pens. "One ate three and a half bushels of corn in the ear in nine days, and gained nineteen pounds. Another ate, in the same time, one and three-quarter bushels of corn ground, and gained nineteen pounds; while the third ate, in the same time, one bushel ground and boiled meal, and gained twenty-two pounds."

The society of Shakers, at Lebanon, New York, communicated the following to the Agricultural Report of the Patent office: "The experience of thirty years leads us to estimate ground corn one-third higher than unground as a food for cattle, and especially for fattening pork. Hence it has been the practice of our Society, for more than a quarter of a century, to grind all our provender. The same induces us to put a higher value upon cooked than raw meal; and for fattening animals, swine particularly, we consider three of cooked equal to four of raw meal. Our Society, annually, for some twenty-seven years, has fattened 40,000 to 50,000 pounds of pork, and it is the constant practice to cook the meal, for which purpose six or seven potash kettles are used."

Mr. R. A. Avery, of Syracuse, who steamed for a large stock in the winter of 1867–68, in a letter just received says: "I bought a new six horse steam-boiler with eight flues—built a boiler-house separate from the barn—run a steam-pipe seventy feet to the steam-box in the basement of the barn holding 400 bushels. On the floor above I cut the hay, wet it and put four pounds of pea meal on two bushels of hay, and have fed from sixty to eighty cows. Milked daily about fifty of them, and out of the lot have sold twelve of the oldest (after milking them every day), to the butchers; and could sell one-half of the balance to the butchers. (Not first quality beef, but such as is freely sought in this market.) I think I have saved ten dollars per head on keeping, say $600 on the stock fed. besides having the milchcows in much better

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condition than ever before in April. I think it saves one-third of the food."

Mr. William Birnie, of Springfield, Mass., in a letter to the Country Gentleman says: "I have practiced cooking food for my stock since 1858, with constantly increasing confidence in its economy. In the autumn of that year I found myself with a stock of twenty head of cattle to carry through the winter with the forage provided for six, and was, consequently, forced to cast about for the most economical method of solving that seemingly impracticable problem. I immediately set about preparing to cut and steam the fodder. * * * * *

I feed with the steamed mixture morning and evening, and with good dry hay at noon. * * *

My stock for several years consisted of about fifty head of thoroughbred Ayrshire cattle and five horses. Since writing the above, I have seen the article in your issue of October 10, by Mr. Stewart, and fully endorse all he says in regard to the economy of this mode of feeding, and of the condition of the cattle thus fed. I consider the saving even more than he names."

The article mentioned by Mr. Birnie stated the saving in cooking to be, "at least, one-third of the food."

Such is the general tenor of the testimony of those who have tested cooking, fairly, in this country. It will be seen that most of the experiments relate to cooking grain. Steaming coarse fodder has not been extensively practiced here, but when a fair trial has been given, the result has been quite satisfactory.

Prof. Horsfall, of England, has practiced mixing a special food for milch cows, to produce a large yield of milk of good quality, and to keep up the flesh of the cow in a full flow of milk. He says: "I now proceed to describe the means I am using to carry out the purposes, which I have sought to explain. My food for milch cows, after having undergone various modifications, has, for two seasons, consisted of rape cake, five pounds, and bran, two pounds for each cow, mixed with a sufficient quantity of bean straw, oat straw and shells of oats, in equal proportions, to supply them three times a day as much as they will eat. The whole of the materials are moistened and blended together, and, after being well steamed, are given to the animals in a warm state. The attendant is allowed one to one and a half pound per cow, according to circumstances, of bean meal, which he is charged to give each cow in proportion to the yield of milk; those in full milk getting two pounds each per

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day, others but little. It is dry and mixed with steamed food on its being dealt out, separately. Bean straw, uncooked, is dry and unpalatable; by the process of steaming it becomes soft and pulpy, emits an agreeable odor, and imparts flavor and relish to the mess. In albuminous matter, which is especially valuable for milch cows, it has nearly double the proportion contained in meadow hay. Bran undergoes a great improvement in its flavor by steaming, and is, probably, improved in its convertibility as food. Rape cake has a large proportion (nearly thirty per cent.) of albumen, rich in phosphate and oil. * * * * * * * *

During May my cows are turned out on a rich pasture near the homestead, towards evening they are again housed for the night, when they are supplied with a mess of steamed mixture and a little hay, each morning and evening. I have cooked or steamed food for several years, and my experience of its benefits is such, that if I were deprived of it I could not continue to feed with satisfaction." Transactions of the New York State Agricultural Society of 1856, page 224.

Mr. Mechi, near London, has also practiced cutting and steaming straw, mixed with materials similar to Professor Horsfall. His experiments have been quite extensive, and the results most favorable to cooking food. His practice has not generally obtained yet in England, but it is constantly extending, and in this country stock feeders are just beginning to turn their attention to the subject.

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ADDRESS

DELIVERED BEFORE THE NEW YORK STATE AGRICULTURAL SOCIETY, AT THE ANNUAL MEETING, ALBANY, FEBRUARY 12, 1868.

BY MARSENA R. PATRICK.

Gentlemen of the New York State Agricultural Society:

I come before you this evening, in accordance with long established usage, to present some of the results of my observations in regard to the agricultural interests of the State generally, and of its Agricultural Society especially, during the time I have been charged with the duties of its presiding officer.

CHARACTER OF THE SEASON.

The year just closed has been one of marked peculiarities, and unusual conditions of the atmosphere, as recorded in the meteorological tables kept in different sections of the State; these tables showing, at the same dates, a very large amount of rain in one part of the State, and a burning atmosphere in another. The crops of the east were only with the greatest difficulty secured, in consequence of rain, while vegetation in the west was dried up, the brick-like earth rendered it incapable of tillage, and flocks, and herds, and man, himself, were suffering for water. Never before, since the settlement of Western New York, has mother earth been known to hold so little moisture in her bosom as in the last half year of grace, 1867.

CAUSES.

Such being the case, it becomes us, as intelligent cultivators of the soil, to inquire into the causes of this wide spread calamity that has come upon us. Whether it is through any agency of man that times and seasons change; both seed time and harvest, and that in vast districts, the latter rains have not fallen upon the dry and thirsty earth in their appointed seasons.

DESTRUCTION OF FORESTS.

Has the wholesale destruction of our forests nothing to do with this sweeping over and beyond us of the heavy rain clouds? Can we continue to sweep away all our growth of timber in every arable

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district, and even denude our rocky hill sides and mountain tops without incurring the penalty?

Can we expect to escape the operation of a universal law that has produced uniform results, in all countries and in all ages? Wherever this law has been violated, sooner or later, the lands have become desolate and the cities have perished. Palestine and Syria, Egypt, and Italy and Spain, and even France, have seen their most fertile and prosperous regions turned into forsaken wilderness, and their most productive lands into arid, sandy deserts.

Even the short reign of our boasted Yankee enterprise on the Pacific coast, has dried up many of the streams that found their sources high up those Western slopes. Some of those slopes and mountain tops, have already been stripped of their leafy covering, and so little rain now falls, in certain localities on our western coast, that crops can scarcely be grown, where, fifteen years ago, the earth was fairly burdened with the weight of its harvest.

The statistics of the pump trade, where followed up (in States west of our own, especially), show a gradual increase in the length of tubing, requiring, in Central Illinois, an addition of nine feet within the last ten years; and in other localities, nearly, or quite as large an increase.

Why there should be such almost universal apathy on this all important subject, I cannot understand, when the statistics of the lumber trade, and of the number of acres brought under cultivation from forests, are laid before the people every year. Statistics which show us, conclusively, that at present rates of clearing up our lands, the next ten years will sweep off all the valuable timber of *this* State, except what is found in the great North woods, and the most of that is of inferior quality.

Legislation should be invoked, before it be too late, to preserve that forest, at least, and thus save Central and Western New York, from the entire change of climate that must follow the opening up of the Adirondac mountain region, making a pathway for the winds and storms from Labrador and the northeast, to burst upon us in all their unchecked fury.*

* As the limits of an address, on an occasion like the present, will not permit an extended discussion upon forests and plantations, as effecting the meteorology of the State, I would refer any person who may feel an interest in this subject, to a few works published in this country and accessible to all; through which, if further information be desired, acquaintance can be made with foreign authorities upon all these interesting questions.

And first, let such person take up "Maury's Physical Geography of the Sea," for a good general idea of the great wind currents that prevail upon our continent, and of the

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CHANGES IN HUSBANDRY.

In coming back to your Society and its associations after an interval of almost six years—years crowded with great events that might well have taken up a century—I could not fail of being continually and strongly impressed with the changes these last few years have made in the system and management of farms generally in the State of New York.

True, these changes had begun, with the opening of railways throughout the north and west, before the war; but war agencies, and consequences, have developed results rapid and varying as the forms and tints of the revolving kaleidoscope. As already noticed, changes have come over us from the increasing instability of the seasons, as well as from changes in the soil itself, by the exhaustion of those elements found in the soil of most newly opened countries; changes from the universal use of labor-saving machines on the farm, and changes arising from the introduction of the "factory system" for dairies.

FARM LABORERS, ETC.

Changes, too, there are in the personnel as well as the material employed in carrying on the operations of the farm. For he who hires farm laborers now, can seldom obtain native born young Americans—farmers' sons, bred up on their father's farms, and *at home* in all the minutiæ of farming—such as were the "hired men" upon our farms in days of yore. Nor is it any less difficult, in most districts of the State, to obtain a farmer's daughter as the "hired girl," either for housework or dairy.

To obtain skilled labor now-a-days, is, in fact, one of the greatest difficulties to be contended with in carrying on a farm. Fortunate,

agencies through which our springs, rivers, lakes and water courses are supplied with water (pages 87 and 88 and 138–140).

Then let Marsh's "Man and Nature," be carefully read, especially "The Woods," (Chap. 3) for a good general idea of their influences—electrical, thermometrical and hygrometrical—upon contiguous geographical districts. The whole book is full of instruction on these and kindred subjects.

The "Michigan Board of Agriculture," has commenced a series of observations within its own State, and the results already obtained are of great practical value. They may be found in its "Reports" for 1865 and 1866; articles, "Observations on the Meteorology of Michigan," and "Appendix," of 1866; also, in "Address of Prof. R. C. Kedzie, of the Michigan State Agricultural College, before the Livingston County Agricultural Society, 1867.

There are, also, exceedingly valuable papers on trees, forests and plantations, in the "Report of Department Agriculture for 1864," from J. J. Thomas, and in 1865, from Frederic Starr; while, for a very able paper on the "Adirondac, or Great North Woods," read C. Watson's report in "Transactions of New York State Agricultural Society, for 1865."

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indeed, is it for us that so many labor-saving machines were introduced before this great want had become *so* great; and that cheese factories, and even butter factories, are relieving, in some degree, the overtaxed wives of our farmers, who are dependent upon foreign help.

Do not understand, by these remarks, that I do not fully comprehend and appreciate our indebtedness for individual and national prosperity to the strong arms and stout hearts of our foreign-born population; but that class of laborers require long and patient teaching before they are capable of managing our machines, or handling our teams, or of understanding our system of farming generally. Yet these men are apt to expect the wages of first class American farm hands.

If to these considerations be added the fact, that as a general rule, unmarried men of that class are unsettled in their habits, roving, and without local ties to bind them; ready to leave for trifling causes, or small inducements in the way of higher wages; the question becomes a very serious one, indeed, "What are we to do for reliable Farm Laborers?"

THE COTTAGE SYSTEM.

The "Cottage System" appears to present the most favorable solution to the problem, for both the farmer and the laborer, as well as for the best interests of society generally. By the erection of snug cottages, at convenient positions for attending to farm work, and the employment of married men as permanent farm laborers, not only boarding themselves but such other occasional help as may be required from time to time, the farmer's wife is relieved from the burden of caring for a houseful of hired men, and will, in all probability, secure, from the wife and daughters of the cottager, such female help as may be wanted in her own kitchen, or dairy.

Wherever this system has been introduced, it has given the best satisfaction to all parties; especially to the laborer, inasmuch as it gives him a home—a castle of his own; making him realize that he too is a householder and a citizen. His self-respect is increased, his manhood is developed, he acts more considerately; your interest and his become more and more identified, and your influence in moulding and Americanizing the ideas of his growing family is as potent, quite, as his own. Hitherto, only the wealthier classes of our agriculturists have adopted this system; but there seems, now, to be a necessity for the adoption of some such system by farmers of the middling class and those who own smaller farms.

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FAMILY CHANGES.

The times change, and we change with them. Our habits of life and style of living change with every decade of years. Only a few of our sons and daughters inherit the rural tastes of their parents. They tread not in our footsteps, and when once they launch forth from the old homestead, in the quiet country, they return not again. The "Old Folks" are left there alone. But can *they* remain?

Look through the small towns and country villages throughout the State, and what numbers of men you will find, somewhat advanced in years, whose whole lives, until very recently, have been spent upon their farms, where they had acquired a competence, and where they had hoped to enjoy a green old age, in the midst of scenes long, long familiar to their eyes, and associations and memories dear, almost, as life itself.

But with increasing years and failing health, unable longer to endure the toils of the farm themselves, and finding none on whom they could safely rely to manage for them, many an aged couple have been compelled to sell the dear old homestead, with its ample surroundings, and take up with a little village residence, where they *can* live alone, and be free from many burdensome cares, during the closing years of life.

The "Cottage System," to which I have referred, affords but partial relief in cases like these, alas, now too common!

AVERSION TO MANUAL LABOR.

For years past, our boys and and young men have exhibited a growing aversion to honest, manly toil, to manual labor, or productive industry of any kind.

In many of our counties, it is becoming a rare sight to see a young man, possessed of an ordinary school education, with perhaps a term or two at the village academy, engaging himself in any kind of sober manual labor.

If he does remain on the farm, in a large majority of cases, less of his time is spent behind the plow, than in a trotting sulky—more of it devoted to training fast nags than to training steers; and farm wagons are less to his taste than spider wheels and skeletons.

Speculation, mining, petroleum, patent rights—*anything* that demands travel and produces excitement, has a fascination for the young man that seems irresistible.

To be *in* the great busy world, and *of* it; to talk familiarly with business men, of thousands, and ten of thousands, and hun-

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dreds of thousands of capital, with which *self* is, in some way, connected, has a charm for the young man, who seldom remembers the vast multitudes that sink to ruin while struggling for prizes that only one in a thousand can, possibly, obtain.

The very term "commerce," carries with it a kind of spell, and men forget that commerce often proves, by its superfluous and extravagant importations, the ruin of both individual and national prosperity. Cannot young men read this lesson from the many wrecks of splendid fortunes, this day floating in the city of New York?

Commercial pursuits are over-valued because they lie more upon the surface, and are open to observation; but from statistics of only a very few years ago, and probably correct now, we know, that our annual growth of breadstuffs, is three to four times the aggregate value of all our imports and exports combined—that even our grass crop exceeds in valuation our whole outward and inward movement of foreign commerce. But it is not alone the young man of some pecuniary means, that leaves the farm to engage in seme doubtful, yet exciting enterprise, that will bring wealth without labor; there is scarcely a day that passes, in village or in country, that some stout, healthy young man is not met, canvassing for some book, some map or picture; selling some patent clothes-wringer, or clothes-pin—a hat-hook, a hat-peg, or a tooth-powder —something of which, with his robust health and strong frame, *he ought to be ashamed*, as beneath the dignity of an able-bodied man.

True, the recent war has had *some* agency in producing this state of things; for young men who have spent from two to five years in camps, have fallen into habits that are the opposite of industrious labor, and very many of our young men *were* with the army, for longer or shorter periods. But, admitting the influence of this agency to its fullest extent, it will not account for the idea, so widely prevalent, that manual labor is degrading, and that American young men should feel above it.

IS LABOR HONORABLE?

Whenever labor ceases to be honorable in the eyes of any people, the doom of that nation is sealed.

All the lights of history are shining on the ruins of nations that degraded labor, committed it to serfs and slaves, then perished from their own voluptuousness and effeminacy. Without a sturdy yeo

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manry, cultivating their own lands, no nation has been able for any long period, to remain free, virtuous and prosperous; and until this cardinal principal, that "labor is honorable," resumes its sway over the minds of our people, we may well tremble for our free institutions.

It is to this hatred of labor we are to look, in a great degree, for the parentage of those crimes that make us shudder—a daily list under which the press groans. It is one great cause of those gigantic frauds upon our banks and money institutions, for the knavish peculations of government contractors and State officials, for the bribery of Legislators and the reckless expenditure of public money for private purposes, sinking us as a people, under heavier debts and greater burdens, than are borne by any other nation on the face of the earth.

ITS INFLUENCE UPON A STATE.

Bear with me while I add a few more words on this important subject.

Whenever we find a country divided up into small estates, each and every owner working his lands with his own hands, we find a brave, patriotic and free people, enjoying competence and domestic comfort with manly dignity. So it was in the earlier days of Roman power, when seven acres of land was the quantity fixed by law, for each citizen. Aye, and under that law, and on a seven acre homestead, was reared up that grand, old, historic character, a Roman citizen—that man before whom kings grew pale; and nations trembled, when he left his plow to buckle on his sword!

Would you look at the reverse of this picture, and mark the results of degrading honest, manly, free labor? You have but to travel a few hundred miles south, where the original system of very large estates, requiring a numerous tenantry, induced a resort to slave labor, and—you know the rest.

Let us, then, as farmers, cultivators of the soil, and intelligent citizens of a great nation, bear in mind the relations *we* sustain *as such*, to the government under which we live, and the nation of which we form a part.

It is an axiom in political economy that countries are not cultivated in proportion to their fertility, but in proportion to their liberty;* and to this axiom I may be permitted to add two or three other principles of political philosophy.

* Montesquieu, Spirits of Laws, Book 18, ch. 3.

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1. That property in the soil is the natural foundation of power, and consequently, of authority; the sovereignty of a state being an inseparable attribute of property in the soil; and the terms "property" and "dominion" being, according to Lord Bacon, convertible terms.*

2. That agriculture constitutes the basis of happiness and prosperity in a state; being, of necessity, the great pursuit of man, and the nurse of the human race.

3. That inasmuch as national authority, and power, and dominion are based upon that pursuit which gives food to all the human race, agriculture is, beyond all doubt or questioning, the most honorable as it is the most ancient of all professions.

CHANGES OF MARKET.

I have dwelt so long upon this subject of labor that time will not permit me to speak of the changes in the husbandry of our State, growing out of the new demands of the market, and the introduction of crops different from those raised a few years ago, before the sceptre of New York, as the great wheat-producing State, was transferred to the regions farther west; changes, too, arising from the facilities afforded by rails and steam for placing fruits and vegetables of every kind, and milk, and eggs, and butter, and cheese, and meat, and poultry, and fish, daily, upon the tables of the consumers in the great cities, fresh from the hands of the producer, who lives far back, hundreds of miles it may be, in the country.

CULTIVATION OF SMALL FRUITS.

Year by year hundreds and hundreds of acres within our State are added to the area already under cultivation for supplying the market with small fruits—the currant, the raspberry, the strawberry, the blackberry, and, to a still greater extent, the native American grape, in almost numberless varieties; grape growing having become, in fact, the leading interest in several districts of the State, and destined to extend far more widely as grape culture becomes more generally understood.

PISCICULTURE.

Fish breeding, too, though in its infancy among us, is attracting the attention of intelligent, enterprising, practical men, with whom success is certain, if legislative action can be obtained to protect their fish preserves from poachers.

* See Harrington in "Oceana," Lowman in Civ. Gov. Heb., chap. 2, and John Adams in "Defence," Letter 29.

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DAIRY AND SHEEP.

I need not speak of the great dairy interest, now so thoroughly identified with the agriculture and husbandry of this State; nor of its wool growing interest, while our many superb flocks, of almost every variety of sheep that can be named, challenge the admiration of judges and breeders from every sister State.

THOROUGHBRED STOCK.

Still less needful is it to refer to the success of our breeders of thoroughbred neat stock. Their representatives are pointed to with pride in every State and territory. Even old England herself, the mother of them all, gracefully accords to American dukes, countesses and maids the highest honors of the Short-Horn peerage, and welcomes to the stables of royalty itself the Durham herd from Geneva.

RINDERPEST.

In this connection, it gives me pleasure to state that the disease among cattle known as "rinderpest," which recently made such fearful ravages among the herds of Britain, is believed at present to exist, as an epidemic, only in the province of South Holland, having entirely disappeared from the British Isles, after causing the loss, as officially stated, of 335,838 head of cattle, of which 56,911 were slaughtered by the authorities commissioned to stamp out the disease.

The weekly return of the Royal Commission, for the week ending 14th September last, exhibited the first clean bill of health, and this being followed by others showing entire freedom from the disease, an order in council was issued, to take effect on the 15th October, modifying previous orders relative to the landing of foreign cattle.

No cases of rinderpest having shown themselves after about the 10th of September, an order in council of the 18th November, revoked all restrictions on the importation of cattle from the Netherlands, the province of South Holland excepted.

Happily for us, the Rinderpest has never crossed the Atlantic; and is entirely unknown on this continent. That this immunity from cattle plague is largely due to the vigorous measures adopted by both the General and State Governments, there cannot be a doubt; while the appointment of a Commission by the Legislature of this State, fully empowered to crush out the disease at the instant of its appearance, has had a tendency to calm the excited minds of stock owners, and allay the fears of persons interested in this department of husbandry.

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Here, as in England, frequent false alarms are raised, and "Rinderpest" is reported, by the press, as prevailing in certain districts. In every case, however, when examined by a Commissioner, or by a competent surgeon, gastric fever, Texas murrain, pleuro-pneumonia, or cerebro-spinal meningitis has been identified, and the alarm has ceased.

ABORTION.

The subject of abortion among cows has engaged much attention from the Executive Committee during the year; but as Prof. John C. Dalton, of the College of Physicians and Surgeons, to whom the whole investigation was committed, is to address you this evening, himself, it is not necessary for me to say anything on this very important subject. An appropriation will be asked of the Legislature to continue the investigation so successfully initiated.

FLAX COTTON.

The appropriation made by the State for perfecting machinery to cottonize flax, not having been claimed by an party to whom the Board could award it, under the terms of the law, the Treasurer of the Society, acting under the direction of the Board, has returned the money to the treasury of the State of New York,

TRIAL OF IMPLEMENTS OF TILLAGE AT UTICA.

There are many of the operations of the State Agricultural Society, for the last year, of which I do not propose to speak at length, as a detailed report from the Secretary, in behalf of the Executive Committee, has been to-day presented; and a report from the Hon. John Stanton Gould, Chairman of the Board of Judges on the Trial of Plows at Utica, will be ready for publication within a few days.

In regard to the latter I feel warranted in saying, that if the results of the Trial of Harvest Implements at Auburn, in 1866, have been of incalculable value to the interests of agriculture in all countries, the Trial of Implements of Tillage, at Utica, in 1867, if less brilliant in display, may prove to be even more useful, in its final results, than that of 1866.

The call of the Society, through its Executive Committee, for "a plow for stubble land, which will cut a furrow twelve inches deep, and not less than five inches wide, drawn by three horses, and raising the lowest soil to the surface of the furrow," was deemed, by most persons, an exhibition of ignorance on the part of those who put it forth—a demand for an implement, involving conditions

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that could not, by any possibility, be combined in one and the same plow.

But the inventive and constructive mind of Governor Holbrook, of Vermont, triumphed over seeming impracticabilities; and he was enabled, from his life-long study of the principles involved in turning up and mellowing the soil, to bring before us a plow, differing in many respects from all other plows, moving forward with comparative ease, yet bringing up, from hitherto undisturbed depths, new farms, to mix and mingle soils with the old.

For his civic virtues, his statesmanship and patriotism in the dark days of our country's history, the Green Mountain State conferred the highest honors in her gift, on this, her favorite son; but, if I mistake not, this *plow* will be his enduring monument, when all his political honors are forgotten.

To use his own words, from a note to me on a kindred subject; "good plowing lies at the foundation of civilized life, and when you sift the whole thing down, civilization cannot advance far, in other relations, beyond the advancement in tillage of our good mother earth. The plow must be the foundation of all good tillage"—a sentiment to which every true farmer will respond "amen."

Besides the Holbrook plow, there were other plows of great merit exhibited, as well as cultivators, harrows and other implements of tillage, full notices of which will be found in the forthcoming report.

EXAMINATION OF MACHINES, IMPLEMENTS, ETC.

In this connection permit me to make a suggestion, which, though it may not be convenient to act upon at present, may afford matter for reflection, and elicit plans for action at some future meeting.

To any one who is an observant visitor at our State, county, or club fairs, and exhibitions of farm implements proper, as well as machines and implements *indirectly* connected with agriculture, it is painfully evident, that no proper examination *can* be made of such entries, in the limited time given, and under the pressure committees must, of necessity, at such times act; even admitting their competency as judges.

Add to this the fact, that every year very many inventions and improvements are patented and then lost sight of, for the want of ability or tact on the part of the patentee in bringing them before the public, and we are forced to the conclusion, that we know very much less than we ought to know of the *real* value—the actual merits and demerits—of a great many machines and implements

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that have passed through the patent office, even though some of them *may* have received from various societies, including our own, first class premiums.

It has occurred to me that by the employment of a suitable person as an expert, to examine and report to a committee of practical and scientific men,* on all new or not thoroughly tested machines and implements pertaining to agriculture (whether presented to the Society for examination, or sought out by such expert, through agents, manufacturers or the patent office), all necessary data might be obtained for instituting competitive trials and critical examinations under the direction of this committee of judges, at little expense to the Society or to competitors.

Every report of the expert to this committee, (after being passed upon by the committee, and the committee's remarks indorsed thereon,) would be placed on file in the Secretary's office for reference, and by this means a vast amount of reliable information would be gathered up, from year to year, and made available to the Society.

I will not occupy your time by an enumeration of the many advantages that might, as it seems to me, be derived from the employment of some such expert, engineer or machinist; nor of the errors, frauds and impositions against which he would guard *us*, but will leave the subject with the Society for future discussion, if it be deemed worthy of notice; and it might be well, perhaps, for the new Executive Board to bear this suggestion in mind, while the revision of the premium list, (now in the hands of a committee,) is in progress.

FAIR AT BUFFALO.

The Twenty-seventh Annual Fair of the Society, held in the city of Buffalo, notwithstanding some untoward circumstances and many fears, was a decided success taken as a whole; and in some of the departments the display far exceeded that of any former year; especially was this the case in the departments of implements and machinery.

Probably such a number and variety of machines and implements, directly or indirectly connected with husbandry, and of such great excellence, were never before brought together in any place; and it was a matter of universal regret, that the brevity of

* The Bureau of Experiment, if you please, recommended by my immediate predecessor in his address last year.

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the time allotted, rendered it absolutely impossible for the judges to give each article the thorough examination it should have had, that its real merits might be made public.

Notwithstanding the untiring labors of the Society's Engineer, and several of the Ex-President's, many articles were, of necessity, but cursorily examined.

Until some such bureau, as has been suggested, be organized, or a special examiner appointed, might not the Society's Engineer, acting under the the special instructions of the Board, take with him a short hand clerk, begin his examinations before, and continue them after the close of the fair, making his report at the next meeting of the Executive Board?

As very full accounts of the fair, in all its departments, have been published, and are on file in the archives of the Society, I pass by any further details, that I may say a few words, before I close, upon the general workings of the Society.

SUGGESTIONS AS TO A CHANGE OF THE SOCIETY'S POLICY.

In looking back at our requirements for the fair held at Buffalo in 1857—a Fair which at that time had never been equalled, and but rarely since—I have been led to examine, with much care our present system of management, and to ask in all sincerity, whether the system which worked admirably during the infancy, youth and adolescence of the Society, is competent to meet the yearly increasing,demands of this great institution, now in its full maturity, and the pride of our State?

First of all comes up the question. Are the provisions now made for the shelter and protection of property on exhibition, such as to assure exhibitors of its safety?

2. Are the arrangements annually made for the erection of temporary, rough-lumber buildings, (of necessity frail and unsubstantial,) in keeping with the character and dignity of a Society representing this great State?

3. Is the present system, in any true sense, economical, judicious or comfortable; whether for the society, for exhibitors, or for the public?

4. With the yearly increasing demand for more extended accommodations, will the cities of our State continue to meet our requirements; labor, lumber and material increasing in price, from year to year, as well as in the amount required?

It is not of the past I speak, nor of systems that were adapted

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to the past; it is of the *present* and of the *future*. The times have changed and our people have changed. Those inducements which twenty, fifteen, ten years ago, caused the citizens of our most desirable localities to put forth spirited efforts to secure the Fair, no longer exist in more than one, or at most, in two localities. To confine the exhibitions under the existing system, to these one or two places only, would be to localize the Fair, and to neutralize the Society's influence.

In traveling over the State and conversing freely with a large number of the most intelligent friends of the Society, within the last year, I find a very general idea prevalent, and gaining strength, that by changing the system now pursued, for one that will give *permanent buildings* in three, four, or five centers, where the Fairs *shall be held in rotation*, all the benefits we now derive from the present system will be retained, and many advantages gained; such as stability, economy and the fostering of emulation in the districts where the Fairs are located.

It may be said, that this subject has already been acted upon by the Society. True; but the last time it was before the Society, was *twelve* years ago; and could any one foresee, twelve years ago, what and where we are now? And what was that action?

In 1853, a very able committee, composed of eight members, viz.: Elon Comstock, of Rome; Charles S. Wainwright, of Rhinebeck; Anthony Van Bergen, of Coxsackie; James McDonald, of Salem; Paris Barber, of Homer; Thomas B. Arden, of Beverly; and Hugh T. Brooks, of Wyoming; was charged with the duty of examining the whole subject, and presenting the results, in the form of a report, at the next annual meeting.

That report may be found in the Transactions of 1853 (though read at the annual meeting in 1854), and every argument *then* adduced in favor of a change, is clothed with still greater power *now*. Even Canada, which then gave her voice in favor of the migratory system, abandoned it, some years ago, for permanent locations. Whenever the question was referred to committees, or to county societies, the vote was for permanent locations.

In 1856, at the annual meeting, the subject was, for the last time, called up, and the present system re-affirmed.

There are various other modifications demanded in the working of our fairs; in the classification of entries, and closing of the entry books; in the attendance and duties of judges; in the expenses of officers composing the Executive Board; in the arrange-

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ment of the library, so that it may be made available for reference by any farmer desiring information on specialties in agriculture; all, however, so intimately connected with, and dependent upon the main question, "Shall we continue our present system?" that it seems unwise to discuss them until that question shall have been decided.

I have made these suggestions in regard to a change of our system, out of respect to what appears to me a strong public sentiment, pointing unmistakably in that direction; and I leave it with you, gentlemen, to be disposed of as you, in your wisdom, may deem best; satisfied that you will, in the future as in the past, make it your study to promote the great interests represented by this Society.

CONCLUDING REMARKS.

It is from this consciousness of the high purpose by which the Society is animated, and the strength of that bond which unites its active membership in a common brotherhood, that in its service individual sacrifices are so generously made, and the most arduous labors are cheerfully given.

To the gentlemen of the Executive Board with whom I have been so pleasantly associated during the past year, I desire to express my hearty acknowledgments for the aid and support so promptly rendered at all times; and especially do I desire gratefully to recognize my obligations to the gentlemen in charge of departments for their thoughtful kindness and delicacy in lifting from my shoulders many of the burdens I could not well have borne.

May they find ample reward for their labors, year after year, in witnessing the increased prosperity of the cause for which they have so faithfully borne the burden and heat of the day; and when, in their turn, they shall stand where I have stood the last year, may they, too, find in those on whom they shall lean not only wise counsellors and strong men, but younger brothers, endeared by common toils in the same broad field, and by ties that years have rendered strong as the ties of blood itself.

My last, but not least weighty acknowledgments, are due to the venerable Secretary who has been the father of us all—who for twenty years, has been the faithful mentor to every President, and the strong pillar of his support; the wise counsellor of our inexperienced officers, and the discreet manager of the affairs of the Society. To this Society, next to his God, he has consecrated the

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best years of his life, and we owe him a debt we can never fully repay; but, so long as it shall please "Him in whose hand is the breath of all mankind," to prolong his days, may "that good gray head that all men know," never be missed from its place at our council board.

GOV. KING.

From the active, stirring scenes of the present, let our thoughts turn for one brief moment, to "the memory of joys that are past, pleasant, but mournful to the soul."

Since our last gathering here, one noble and dignified form that was wont to move among us has passed away, and these halls which knew his step so well, will echo to that step no more, forever. Everywhere, that presence, grand in its simplicity, was hailed with gladness, and to this Society, that presence was a living benediction. Of all its friends and patrons, none more truly loved this Society, and none have been more truly loved, or more deeply mourned. In that quiet church yard by his old homestead, and on that spot he had himself selected long years ago for his own resting place, John A. King sleeps his last sleep—Aye, and he sleeps well!

"Green be the turf above thee
Friend of my better days,
None knew thee but to love thee
Nor named thee but to praise."

Gentlemen of the Society:

My last official duty remains to be performed—a very agreeable one to me, inasmuch as it enables me to express my own gratification that you have been so fortunate as to secure for the Society as its official head for 1868, a gentleman whose rural tastes and love of practical agriculture have bound him to us through all the years of an active and successful business life in the great city. I have the honor to introduce to you, Thomas Hall Faile, of New York, as the President elect of the New York State Agricultural Society.

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REPORT

OF J. C. DALTON, M. D., COMMISSIONER OF THE NEW YORK STATE AGRICULTURAL SOCIETY FOR THE INVESTIGATION OF ABORTION IN COWS.

Mr. President and Gentlemen of the Society:

Immediately after the appointment of the commission for the investigation of abortion, in April last, measures were taken to carry out the designs of the Agricultural Society, by collecting all the facts which could throw light on the causes of abortion and the means of its prevention. The first object of the commission was to ascertain, if possible, the cause of the malady, by acquiring more definite information on the following points, viz: 1st, its locality and extent; 2d, its previous history; 3d, the number and kind of cattle affected by it; and 4th, the present condition of the dairy farms, and the management of cattle in the affected districts.

For this purpose a list was obtained of the officers of all the county agricultural societies in the State of New York, and communications were addressed to the presidents of the agricultural societies of other States, requesting a list of the officers of their respective county societies. In this way the commission came into possession of the names of the officers of county societies in the States of New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Ohio, Michigan, Illinois and Iowa. A printed letter was then addressed to these officers, desiring a list of the farmers in their immediate neighborhood, in the following terms:

"NEW YORK, *May* 1, 1867.

"Mr. ——, *President of the* —— *County Agricultural Society:*

"DEAR SIR—The New York State Agricultural Society has set on foot an investigation for the purpose of discovering the cause, and if possible the remedy, for the troublesome epidemic of abortion among cows, now extending over certain portions of the country. As one means of aiding in this, it is proposed to send to the farmers a circular letter of inquiries (a blank copy of which is herewith inclosed), from which much valuable information is anticipated, if it can be brought to the notice of a sufficient number of those interested. May I ask of you the favor to send me a list, with name and post office address, of all the farmers in your county who

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carry on large or average sized farms for dairy or stock raising purposes, and who would be likely, in your opinion, to furnish ready and correct replies to the accompanying circular.

"By transmitting such a list, with your signature, you will aid very materially in the prosecution of the work now undertaken, and render an important service to the interests of agriculture.

"Any such assistance which you may give will be thankfully received and duly appreciated.

"Yours, very respectfully,

"J. C. DALTON, M. D.,

"*Commissioner of the New York State Agricultural Society.*"

The foregoing letter was sent to 316 different addresses, as follows: In the State of New York, 54; Massachusetts, 25; Connecticut, 10; Rhode Island, 3; New Jersey, 10; Pennsylvania, 33; Ohio, 71; Michigan, 28; Illinois, 29; Iowa, 53.

Through this means, and by the aid of other gentlemen interested in agriculture, it became possible to correspond directly with the farmers and to obtain all the information which they were in a position to afford. A circular and blank form of report, for general distribution was then prepared, as follows:

(*Circular to Farmers.*)

"NEW YORK, *May* 1, 1867.

"DEAR SIR: The New York State Agricultural Society has set on foot an investigation for the purpose of discovering the cause of the troublesome epidemic of abortion among cows, now extending over certain portions of the country. Your aid is asked in the prosecution of this work, and for this purpose the accompanying letter of inquiries has been sent to you. Will you do me the favor to fill up the proper answers in writing, at your earliest convenience, and return the same to my address, with your signature?

"By so doing you will assist very materially in the work now undertaken, and render an important service to the interests of of agriculture.

"Yours, very respectfully,

"J. C. DALTON, M. D.

"*Commissioner of the New York State Agricultural Society.*"

The blank form of report, sent with the above circular, is appended to this report, marked A.

The farmers responded to this appeal with great readiness. During the summer, 4,676 of the above communications were

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distributed, and 1,093 replies were obtained, giving more or less complete information on the points indicated. Very few of the reports thus received were entirely complete; as it was found that circumstances made it impossible for farmers to answer all the questions comprised in them. But nearly all contained some facts which it is hoped will be of service in extending our knowledge on the subject of abortion. The Commission would gratefully acknowledge the interest and promptitude thus manifested by the farmers, in aiding to carry out the design of the investigation.

At the same time, Dr. William H. Carmalt, of New York city, was appointed Assistant Commissioner, and a corps of Assistant Inspectors was organized, for the purpose of visiting the farms of the afflicted districts, and thus ascertaining, by direct examination, such facts as could not be learned by correspondence. Each Inspector served by the month, at a salary of one hundred dollars, the necessary traveling expenses being defrayed from the funds appropriated by the society. The names of the gentlemen who have thus acted as assistant Inspectors, are as follows:

Henry E. Handerson, M. D.; Albert E. Ham, M. D.; Thomas Haigh, M. D.; Daniel W. Kissam, M. D.; Richard F. Halsted, M. D.; Philip E. Arcularius, M. D.

Each Inspector, on commencing his tour, was furnished with a letter of instructions, to the following effect:

"N. Y. STATE AGRICULTURAL SOCIETY:
COMMISSION ON THE EPIDEMIC OF ABORTION IN COWS,
NEW YORK, *May* 1, 1867.

"To "M. D., *Assistant Inspector:*

"SIR: In making your inquiries on the subject of abortion in cows, you will on first visiting a farm, endeavor to collect and record all the information requisite for the main report (of which the necessary blanks are furnished you); after which, you will fill out, in the same manner, the returns for the additional report, making both as complete and accurate as possible.

"You will, in all cases, take pains to collect the desired information from the most responsible and intelligent persons to whom you can have access; and, in those instances where you are compelled to rely upon doubtful sources of information, you will exercise a careful discrimination in regard to the same, never inserting a statement in your report unless convinced of its being made with a reasonable approach to accuracy.

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"In inspecting the stables where the cows are kept, you will observe, 1st, their condition as to general cleanliness; 2d, temperature; 3d, dryness or moisture; 4th, the presence or absence of uncleanly odors; 5th, the mode of fastening or confining the cows, with its effect on the animals' comfort; and 6th, the quantity of space in each direction allowed to each cow.

"Embrace every opportunity which may offer for making a thorough anatomical examination of aborted foetuses, ascertaining whether any parts of the system show indications of disease, atrophy, or imperfect development of any kind; and make a full report of each examination, with all the requisite particulars.

"Examine, also, all newly born calves which you may have an opportunity of seeing, and report whether they present any diseased or unnatural appearance; and if so, what.

"Ascertain and record, so far as possible, all reliable facts which show that healthy pregnant cows are, or are not, liable to abort in consequence of seeing abortion take place in other cows, or from being exposed to any sights, odors, or emanations connected therewith.

"If any opportunity should occur of making the autopsy of cows dead during pregnancy or soon after abortion, make a full examination and report of the same, especially with regard to the condition of the uterine organs.

"No necessary expense is to be spared in obtaining the fullest possible information on the subject which you are to investigate. At the same time, you are relied upon to exercise a judicious economy in husbanding the resources of the Society, and to assist in this way the successful accomplishment of its work.

"At the termination of each month of service, you will transmit to the assistant commissioner, Dr. Wm. H. Carmalt, New York, your reports for that month, together with an account of your expenses during the same period.

"Yours very respectfully,

"J. C. DALTON, M. D.,

"*Commissioner.*"

Each inspector was furthermore provided with a blank form of report (A), similar to those distributed to the farmers, and also with blank additional reports, for the purpose of collecting information of a kind which the farmers could not be expected to furnish. The form for the additional report is appended to this report, marked (B).

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The total number of farms visited by the inspectors has been 1,577; and the entire number of reports thus far received, from all sources, is as follows:

Farmers' reports	1,093
Inspectors' reports	1,577
Additional reports	1,577
Monthly and special reports	12
Total	4,259

The reports have been received from the different States, as follows:

Farmers' reports from New York			494
do	do	Massachusetts	126
do	do	Connecticut	68
do	do	Rhode Island	8
do	do	New Jersey	6
do	do	Pennsylvania	84
do	do	Ohio	86
do	do	Michigan	94
do	do	Illinois	22
do	do	Iowa	105
			1,093
Inspectors' reports from New York		1,507	
Additional		1,507	
Monthly and special reports from New York		11	
			3,025
Inspectors' reports from Massachusetts		70	
Additional reports from Massachusetts		70	
Monthly and special reports from Massachusetts		1	
			141
Total			4,259

From all the above-mentioned States cases of abortion among cows have been reported, but it is only in New York and Massachusetts that they have been sufficiently numerous to excite general attention. In Pennsylvania they have been found to be present in Chester and Cumberland counties, where they amount to ten per cent. of all the cases of pregnancy reported; but they are rare, so far as we have been able to learn, in the remaining portions of the State. In Ohio, Illinois, Michigan, and Iowa the comparative number of abortions is very small. The Commission is in receipt of a considerable number of letters from these States, in which the writers say that they can give little or no information on the subject, because the disease is "unknown" or "has never appeared" in their region of the country.

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In the State of New York information has been received from forty different counties, reporting, in all, 49,749 cases of pregnancy from May 1, 1866, to May 1, 1867, and 2,574 abortions in the same period. The proportion of abortions, therefore, for the entire State, as derived from these data, is only a little over five per cent., or about one abortion in nineteen pregnancies. It is evident, accordingly, that the malady is not generally prevalent in an active form even in New York. The returns show, indeed, that it is located in very different degrees in different parts of the State. In ten counties there was not a single abortion among 641 cows reported in calf for the year 1866–7. In twenty counties, reporting in all 19,804 pregnancies and 661 abortions, the percentage of abortions for each county varied from five per cent. to less than one per cent.; and in the remaining ten counties, reporting 29,304 pregnancies and 1,913 abortions, the percentage of abortion varied from above five per cent. to ten per cent. of the whole number of cows in calf.

There were only five counties in which the proportion of abortions was above seven per cent., viz: Queens, in which it was seven and one-half per cent; Clinton, in which it was eight per cent.; Orange, in which it was nine per cent.; Madison, in which it was nine per cent.; and Lewis, in which it was ten per cent.

The following table shows the percentage of abortion, together with the number of cows and the amount of dairy products of each county, as given by the census of 1865:

STATE OF NEW YORK.

COUNTIES.	Number of cows by census of 1865.	Pounds of butter made in 1864.	Pounds of cheese made in 1864.	Gallons of milk sold in 1864.	Percentage of abortions in pregnant cows, 1866–7.
Broome	20,696	2,291,268	113,922	41,385	0
Cattarangus	30,559	2,412,223	3,635,356	12,512	7
Cayuga	21,794	2,208,049	205,155	91,511	0
Chenango	41,459	4,042,326	2,552,066	11,652	6½
Clinton	13,968	946,725	100,020	6,300	8
Columbia	11,942	965,064	23,447	231,130	5
Cortland	31,920	2,683,773	2,074,155	715	7
Delaware	38,525	5,052,295	35,519	6,046	0
Dutchess	20,014	1,358,722	11,599	8,964,574	0
Erie	31,859	1,558,573	3,344,734	486,206	1½
Essex	9,219	654,174	96,255	970	2
Franklin	15,804	1,226,598	125,732	1,105	2

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STATE OF NEW YORK—Continued.

COUNTIES.	Number of cows by census of 1865.	Pounds of butter made in 1864.	Pounds of cheese made in 1864.	Gallons of milk sold in 1864.	Percentage of abortions in pregnant cows, 1866–7.
Fulton	9,974	706,612	991,002	1,084	2
Genesee	9,009	763,082	80,263	104,622	0
Greene	12,059	1,327,054	16,961	2,192	3½
Herkimer	45,461	958,118	13,893,801	17,686	5½
Jefferson	55,198	3,100,234	5,348,615	278,237	3
Lewis	30,639	1,663,950	4,755,043	138,126	10
Livingston	10,605	1,052,804	101,417	33,233	0
Madison	28,995	1,569,342	3,452,682	13,506	9
Niagara	11,860	966,286	52,260	25,889	3
Oneida	58,417	2,868,740	8,108,540	191,698	3½
Orange	40,096	2,363,661	132,575	8,835,052	9
Oswego	28,393	1,988,060	2,383,806	69,151	1
Otsego	36,040	2,811,199	3,335,144	18,279	3
Putnam	8,426	272,924	1,155	2,841,453	3
Queens	7,893	424,063	.....	939,131	7½
Rensselaer	14,302	1,144,726	528,133	556,638	0
Richmond	1,191	23,575	.....	4,793	0
Saratoga	14,583	1,323,024	185,161	115,556	0
Schoharie	16,506	1,978,640	143,641	4,235	0
Seneca	6,470	690,428	12,331	21,394	4
Steuben	22,785	2,261,034	291,185	22,485	0
St. Lawrence	65,286	5,417,779	2,922,001	119,187	4
Tioga	14,109	1,432,650	49,655	604	1
Ulster	18,561	1,547,217	1,060	134,099	0
Washington	17,315	1,817,397	807,374	21,819	1
Wayne	14,256	1,320,004	90,591	47,305	1
Wyoming	19,499	1,279,761	1,801,781	43,407	0
Percentage of abortions throughout the State for 1866–7,—5.					

It will be seen that the largest percentage of abortions, does not necessarily occur in the counties which contain the greatest number of cows, and in which the business of the dairy is most largely productive; but it varies in this respect, in each direction. Thus, in Lewis county, with 30,000 cows, the abortion percentage is ten per cent; in Madison, with nearly 29,000 cows, it is nine per cent, and in Orange, with 40,000 cows, it is also nine per cent. On the other hand, in Chenango county, with 41,000 cows, it is only six and a half per cent; in Herkimer, with 45,000 cows, it is only five and a half per cent; in Jefferson, with 55,000 cows, it is only three per cent; and in St. Lawrence, with 65,000 cows, it is only four per cent.

The commission has endeavored to ascertain whether the use of

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the cows for producing butter or cheese were of any influence in regard to abortions. This might be the case, owing to a difference in the quality, breeding and feed of the cattle employed for these two purposes. In some instances it appeared as if the cheese producing districts were more liable to abortion than those yielding butter or milk. Thus, in Cattaraugus county, where the annual production of butter, according to the census of 1865, was seventy-nine pounds per cow, and that of cheese 119 pounds, the abortions were seven per cent of the pregnancies; in Madison, producing fifty-four pounds of butter and 119 pounds of cheese per cow, the abortions were nine per cent; and in Lewis, producing fifty-four pounds of butter and 155 pounds of cheese per cow, the abortions were ten per cent; while in Niagara, producing eighty-one pounds of butter and only four and a half pounds of cheese per cow, the abortions were only three per cent.

In other cases, however, the results were different. Thus, in Orange county, producing fifty-nine pounds of butter, with 223 gallons of milk, and only three pounds of cheese per cow, the abortions were nine per cent; in Erie, producing forty-nine pounds of butter and 105 pounds of cheese per cow, the abortions were only a little over one per cent; and in Herkimer, the great cheese producing county of the State, yielding annually over 13,000,000 pounds of cheese, or 305 pounds to each cow, the abortions were only five and a half per cent. It is certain, therefore, that no relation exists, so far as we can ascertain, between the peculiar products of the dairy and the occurrence of abortion in the pregnant cows.

With regard to the previous history of the disease, our only available information has been derived from the inspectors' reports in the five counties of Oneida, Otsego, Herkimer, Lewis and St. Lawrence. In these counties, from the inspection of 1,507 farms, it has been ascertained that abortions have occurred, in very small numbers, as far back as the year 1852. In 1860–61, the number of reported abortions showed a marked increase, amounting in that year to 251. It continued to increase from that year to the present; the number of reported cases in successive years being as follows:

For the year	1861–62	399
do do	1862–63	475
do do	1863–64	742
do do	1864–65	894
do do	1865–66	1,402
do do	1866–67	2,214

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The next point which the commission proposed to examine in regard to abortion relates to the number and kind of cattle affected by it.

It has been suggested that a principal cause of the malady in question might be the exclusive use of the cows for milk-producing purposes and the large quantity of this product obtained from them. In a dairy district, where the sole object of the farmer is to obtain from his cow the largest quantity and the best quality of milk which she is capable of yielding, every other consideration, of course, is made subservient to this end. The cow is raised or purchased, fed and housed for that object alone. A breed is selected when possible which is already known to be liberal in the supply of milk; and every means is naturally resorted to, both in the crossing of the breed and the treatment of the cattle, which is calculated to improve still further this desirable quality. It has been thought that the capacity for producing milk, cultivated in this way through successive generations, might have been increased at the expense of the generative functions, and might thus have originated in the cow a tendency to abortion. If so, the malady of which the dairy-farmer now complains would be merely the result of his own success in forcing up the production of milk to too high a standard; and its only remedy would be again to reduce the production of milk to a more moderate quantity. In that case we should expect to find abortions most prevalent among cows where the yield of milk was considerably above the average.

In order to obtain information on this point, a group of questions was inserted in the blanks furnished by the commission, in which the cows were divided into two classes, named respectively "good milkers" and "ordinary milkers." The first class comprised all cows giving more than four hundred and sixty gallons of milk per year, while the second included those giving less than that quantity. The farmers and inspectors were desired to state, in each case, both how many of the aborting cows and how many of those carrying their calf to full term belonged to each of these two classes. These replies were not given in all instances; but a sufficient number of them were received to lead to a very satisfactory conclusion as to the relation between them. From all the reports, taken together, the results were as follows:

Whole number of good milkers that carried calf to full term....	35,367
Whole number of good milkers that aborted.....	1,900
Total number of good milkers reported in calf.....	37,267

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Proportion of abortions to pregnancies among good milkers, one in nineteen and a half, or a little over five per cent.

Whole number of ordinary milkers that carried calf to full term	7,702
Whole number of ordinary milkers that aborted	477
Total number of ordinary milkers reported in calf.....	8,179

Proportion of abortions to pregnancies among ordinary milkers, one in seventeen, or five and four-fifths per cent.

It appears, therefore, that there is but little difference in liability to abortion between good milkers and ordinary milkers; but that, of the two classes, the ordinary milkers are rather the more subject to the disease.

It was also thought desirable to ascertain whether the occurrence of abortion was more frequent in first pregnancies than in those coming afterward. For this purpose, a comparison was made of the returns from the State of New York, which gave the following result:

Whole number of cows in calf.....	49,749
Whole number of abortions.....	2,574

Total proportion of abortions to pregnancies, one in nineteen, three-tenths, or about five and one-sixth per cent.

Whole number of first pregnancies reported	3,870
Number of first pregnancies with abortion.....	195

Proportion of abortions in first pregnancies, one in nineteen, eight-tenths, or a little over five per cent.

It appears, therefore, that there is no appreciable difference in the frequency of abortion in first pregnancies, and in those of a later period.

The next point which the commission desired to determine was in regard to the time at which abortion takes place in the affected cows. This inquiry comprises two different questions, viz.: First, at what period of pregnancy is the occurrence of abortion most frequent? Secondly, at what season of the year does it happen, in the majority of cases?

The first of these questions cannot be answered so positively as the last. The reason for this is, that the farmers either do not always know exactly when a cow is impregnated, or they do not keep any special record of the fact. If the bull runs with the herd, they only know that a cow is impregnated by her afterward proving to be with calf; and if they send her to the bull at a distance from the farm, they do not always recollect afterward the particular date. Accordingly, if a cow aborts during pregnancy,

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they are not always able to tell when her impregnation took place; or, in other words, how many months pregnancy had been going on. Still the answers to this question which have been received show that so far as our observation extends, there is a very decided preponderance of abortion in certain periods of pregnancy.

The month of pregnancy, at which abortion took place, was reported in 1,180 cases. Out of this number the abortions were distributed as follows:

In the first month of pregnancy	5
do second month of pregnancy	2
do third month of pregnancy	24
do fourth month of pregnancy	57
do fifth month of pregnancy	171
do sixth month of pregnancy	214
do seventh month of pregnancy	288
do eighth month of pregnancy	295
do ninth month of pregnancy	124
Total	1,180

The sixth, seventh and eighth months, therefore, appear to be those in which abortion most frequently occurs.

With regard to the second inquiry our information is more definite. Although the answers to this question are not so full as could be wished, they are still sufficient to indicate very distinctly the seasons at which abortions are most frequently observed. The month in which abortion took place has been reported in 1,758 cases. Of these abortions there were:

In the month of May	12
do do June	12
do do July	3
do do August	1
do do September	15
do do October	56
do do November	164
do do December	343
do do January	385
do do February	405
do do March	274
do do April	88
Total	1,758

By far the greater number of abortions, therefore, take place during the months of December, January and February; February showing a larger proportion than any other month in the year.

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It has been suggested that abortions may take place during the summer and early fall months, of which we have no knowledge; as the immature calves, being at that time quite small, and being dropped by the cow in the fields, might be readily overlooked. It has been thought that this would account for the fact that the first marked increase in the number of abortions, as reported, takes place in the month of November. The cows are nearly always permanently stabled for the winter from the first to the fifteenth of this month; and accordingly abortions taking place after this time would be necessarily noticed by the farmer, while those which happened before the first of November might easily escape observation.

It is indeed possible that a certain number of early abortions may be overlooked from this cause. It is the belief of the commission, however, that the proportion of such cases is not large, and that the list given above is substantially correct; since we find that, in almost every instance, the number of abortions steadily increases, after the cows have been stabled, through the months of December, January and February. In all probability, therefore, this is a natural increase, which begins early in the fall and continues throughout the winter months.

This fact naturally leads us to ask whether the cold weather and exposure of the cattle in imperfectly constructed stables may not have something to do with the production of the disease. We are induced to believe, however, that cold and exposure have but little influence in this direction. First, because the occurrence of abortion, as a serious malady, is of comparatively recent date, while the cattle are certainly no worse housed now than formerly; and secondly, because in those parts of the country where the exposure of cattle is more severe than in New York, they do not suffer from abortion to a corresponding degree. In the Western and Northwestern States, as we have already seen, abortion is comparatively rare; and in these States the housing of the cattle, during cold weather, is much less complete than with us. A large proportion of the cattle, in fact, are not housed at all, being allowed to remain in the fields night and day throughout the winter months, either entirely without protection, or with only the shelter of a board fence to break the force of the more violent winds.

The following extract from a letter accompanying one of the reports, will serve to show how little effect severe weather sometimes has upon the condition of pregnant cows:

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"BLOOMING GROVE, OHIO, *August* 22, 1867.

"J. C. DALTON, M. D.

"Dear Sir—For the last three years and more, we have bought milk cows and sold to the dairies north of us, on the "reserve," from seventy-five to 125 head of cows each year. We generally commence buying in February, and sometimes hold them until the middle of May. The cows are bought from our neighbors in the county, and are kept in the same manner, and fed on the same feed as our own. When we get them they are turned out into an open field, and fed on hay until we sell. We generally have them in the calving season. Last February we had fifty, kept in this manner, and thirty had calves in the open fields, some in the very coldest weather. They all came at the proper time, and cows and calves did well. We lost but one calf, and the night was so cold it froze.

"If the report is of any benefit, I am fully paid for imparting any knowledge that will aid the Society in their laudable work, in seeking information to arrest the cause of a disease so destructive to cattle.

"Very respectfully yours,

"JAMES MARSMAN."

It is not probable, therefore, that abortion, as it exists in the State of New York, is due, in any great degree, to the influence of cold or exposure.

The same thing may be said of various other circumstances, which might be considered as important in regard to the daily care and treatment of the cows. In a large proportion of cases, even in those counties where the percentage of abortion is large, our reports show that the pastures are amply provided with water and shade; that they are situated but a short distance from the stables, often within a quarter of a mile; that the stables are well built, above ground, sufficiently well lighted, and without serious deficiency in ventilation. There are instances of course, where the cows are not so well cared for in these respects; but even where such imperfections exist, it has not been found possible to detect any definite relation between them and the amount of abortion on the corresponding farms. The truth seems to be this: That where a cow is already predisposed to abort, neglect or improper treatment, or bodily injuries of the slightest nature, will cause the abortion to take place; but so far as our evidence goes, when the cows are otherwise healthy the disease cannot be produced in them,

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to any wide-spread degree, by the ordinary forms of mismanagement to which cattle are exposed.

Among the particular details which have been examined in reference to abortion, was that of *the age at which the cow is first impregnated.* In many instances it is the custom to begin the impregnation of the heifer at the age of from one year to eighteen months. Is this age too early for the healthy exercise of the generative functions? And does the premature use of the heifer for this purpose predispose her to subsequent abortion?

By a comparison of the returns from 1,453 farms the following result has been obtained:

Number of farms having *over* five per cent. of abortions (343), in which the cows are first impregnated at the age of one to one and a half years 242, or seventy and a half per cent., two years and over 101, or twenty-nine and a half per cent.

Number of farms having *not over* five per cent, of abortions (1,110), in which the cows are first impregnated at the age of one to one and a half years 805, or seventy-two and a half per cent.. two years and over 305, or twenty-seven and a half per cent.

The difference between these two classes of farms is not great; but it appears that the farms having the smaller percentage of abortions are those in which the larger proportion of cows are habitually impregnated at the ages of one to one and a half years. We cannot, therefore, attribute the occurrence of abortion to a too early impregnation of the young heifer.

Next to the age of the heifers, that of the *bulls used for service* might be regarded as having a possible influence on abortions. If it were the general practice to use bulls of an insufficient age, it would not be surprising if their progeny should be liable to debility and disease, or should even fail altogether to come to maturity. In that case the cause of the abortion would be not so much in any defect of the cow, as in her incomplete impregnation by the bull. The age of the bulls used for service was therefore a point which received attention in the inquiries made by the Inspectors.

The result of these inquiries was as follows: Bulls are used for service at the age of one year, two years, and three years and over. By far the largest number of cows are impregnated by two year old bulls. The age of the bulls by which the cows had been impregnated was reported in 37,948 cases; and of these, 25,554, or 67 per cent, were cases in which the age of the bull was two years.

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In 9,295 cases it was one year; and in 3,099 cases it was three years and over.

The influence of this difference on the percentage of abortions is given in the following table:

	Number of Cows Impregnated by		
	Bulls aged 1 year.	Bulls aged 2 years.	Bulls aged 3 years.
That carried calf to full term	8,931	24,059	2,873
That aborted	364	1,495	226
Total	9,295	25,554	3,099

An examination of this table shows that of all the cows impregnated by one year old bulls, a little less than four per cent. aborted; of all those impregnated by two year old bulls, nearly six per cent aborted; and of those impregnated by bulls aged three years and over, a little more than seven per cent. aborted. If the age of the bulls, therefore, have any influence as a cause of abortion, it is certainly not because the cows are impregnated by bulls which are too young.

Is it because the bulls are used too much? In other words, does the vigor of the bull become exhausted, during the second and third year, by too frequent service.

So far as we have been able to ascertain, the number of cows usually served, in this State, by one year old bulls, is not over twenty. The average number served during the season by two year olds is about thirty; and the number served by three year olds is about forty. We find, therefore, that the numer of aborting cows corresponds very closely with the drain upon the generative powers of the bulls used for impregnating them; and this circumstance, perhaps deserves the attention of farmers engaged in dairying or in the raising of stock. Still, the average number of cows served, during the season, by even three year old bulls, does not seem to be excessive; and, without further evidence upon this point, we should not be inclined to attribute to it a very serious influence in the production of abortions.

With regard to the *symptoms* exhibited by the aborting cows, very often none whatever are perceptible beyond the mere fact of the abortion. Of 2,331 cases, in which information has been obtained on this point, 1,403 or a little over sixty per cent, showed no distinct indications of sickness, either before, during, or immediately after the abortion. In the remaining 928 cases, or nearly forty per cent, signs of indisposition, more or less severe, were mani-

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fest. When the abortion is accompanied by illness, the symptoms are those described in the following account, which has been compiled by Dr. Carmalt from the various reports made on this subject by the assistant inspectors:

"The only evidence of abortion in the earlier months of pregnancy appears to be that after the cow has been served by the bull and has passed naturally over one or more periods, she is found to be again violently in heat; which is sometimes accompanied by a considerable discharge from the vagina, consisting of glairy mucus, occasionally puriform in appearance and of an offensive smell. This condition of heat lasts longer than usual, sometimes for several weeks; after which, if the cow be again impregnated, she becomes quiet. While in the excited condition above described, the supply of milk diminishes, but not to less than four-fifths or five-sixths of the usual quantity. After the second impregnation, the cow again gives her full supply.

"Later in pregnancy the aborting cow may show some premonitory symptoms of approaching trouble. Perhaps in one-half the cases it is noticed that she loses her appetite, and is either restless, or unnaturally sluggish in her movements. If she has been dried off from milking, the udder will now enlarge, the vulva become swollen, and a purulent or muco-purulent discharge may flow from the vagina. The abortion usually occurs in the night; the fœtus being found in the dung on the stable floor in the morning. The after-birth is usually retained for a variable length of time—from three days to six weeks or more—and is finally cast off piecemeal, accompanied by an extremely offensive, fœtid, purulent-looking discharge. The cow in these cases loses her appetite after abortion, and becomes emaciated and weak. The supply of milk either diminishes one third, one-half or three quarters, or falls off entirely. It rarely continues to the usual full amount."

The occurrence of abortion very rarely proves fatal. From the inspection of 1,577 farms in New York and Massachusetts, reporting altogether 7,176 abortions from the year 1851 to 1867, only fifty cows are reported as having died in consequence of abortion—that is to say, one fatal case in 143 abortions. It is fair to suppose that the real proportion is even less than this, since a certain number of the abortions reported in former years were undoubtedly occasioned by accidental injuries, to which the death of the animal is in part to be attributed.

In order to learn the internal changes which take place in the

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generative organs at the time of abortion, Assistant Inspector Richard F. Halsted, M. D., was requested to obtain for the commission a cow, otherwise healthy, which had been the subject of abortion, and to kill her for the purpose of making a post-mortem examination. He accordingly did so in the month of January last, and communicated the result of his examination in the following report:

"HERKIMER, N. Y., *January*, 28*th*, 1868.

"DR. WM. H. CARMALT, *Assist. Commissioner:*

"DOCTOR: I have the honor to report that I have this day made a post mortem examination of a cow that had aborted on the farm of Mr. John Golden about fifteen hours previously.

"The case was, to the best of my judgment, entirely without complication. The cow was in excellent condition, appearing perfectly well both before and after abortion. I opened and examined her immediately after being killed. Exteriorly the uterus was healthy. Internally I found the cotyledons of the after-birth in various stages of softening, without regard to their size, or so far as I could discover, to their position. The fœtal portion of the cotyledons was easily separated from the uterine. In some instances, even the mere handling, necessary to remove the uterus from the cow, produced this separation. In others the slightest force at the edge would turn out, so to speak, the whole fœtal portion from its uterine connections. In none was there any difficulty in separating them.

"I examined about one-third of these bodies at random. The remainder were of precisely the same appearance exteriorly as the others. Their color was a whitish yellow, like that of pale adipose tissue. The consistency of the uterine portions was tolerably firm; that of the fœtal portions was quite soft. The numerous tapering small tufts, which were removed from the cells of the uterine cotyledons, were generally of a fatty color and consistency. A few of them, however, had apparently passed this stage, and had become firmer and somewhat granular in texture.

"The arteries and veins, proceeding from these bodies to the fœtus, all seemed to be in a healthy condition. Only an inch or two of the umbilical cord could be found; the remainder having been probably lost in the stable at the time of abortion.

"The calf had every appearance of being quite healthy, and none of having been dead for more than a few hours. From its appearance, I considered it to be within about a month and a half of the full term; though its weight was rather low for this age, being only

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eighteen and and a half pounds. Its length was twenty-eight and a half inches.

"The cow was a choice one, about six years old, and had always been in good condition.

"There was no evidence, anywhere, of inflammatory action, past or present. I am of opinion, from all the appearances presented, that the circulation of blood had ceased in the fœtal portion of the cotyledons for some days previous to the time of abortion; and that the immediate cause of the abortion was in the arrest of development thus produced.

"Very respectfully,

"Your obedient servant,

"R. F. HALSTED, M. D.,

"*Assist. Inspector.*"

A portion of the cotyledons, removed by Dr. Halsted in the above case, was sent to New York and examined by the microscope. No changes were found in them, except such as naturally follow from stoppage of the circulation and a partial separation of the fœtal and uterine portions from each other.

The primary cause of abortion is sometimes to be found in the *fœtus itself.* Being imperfectly organized, it dies prematurely, while still in the uterus; and the uterus then expels it as a foreign and offending substance. It was thought that we might ascertain whether this were the case in the present malady by learning what proportion of the calves born alive afterward died from debility or disease. If it should be found that the fatality among calves after birth continued unusually large, it would furnish strong evidence that some original defect of organization was also the cause of the abortions.

The result of our inquiries did not show this to be the case. Of 38,654 calves born alive in New York and Massachusetts, in the year 1866–67, the number of

Those still alive in the fall and winter of 1867, was.....	6,125
Those which had been killed....	32,199
Those which had died from debility or disease.....	330
Total	38,654

The proportion of calves dying from debility or disease was therefore only one in one hundred and seventeen of those born alive during the year. But as the proportion of aborting cows to the whole number of those in calf is one in nineteen, it is plain

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that there is no definite relation between the occurrence of the present form of abortion and an original defect in the constitution of the abortive calves.

It is a question of some practical importance to determine whether abortion be especially *liable to recur* several times in the same cow; or whether a cow, having once aborted, is afterward free from the disease. In order to ascertain this, inquiry was made as to how many, both of the aborting and fruitful cows, had aborted or had carried their calf to the full term, during the previous year. The following is the result:

Number of cows carrying calf to full term, that had aborted the previous year	507
Number of aborting cows that had aborted the previous year	143
Total number of cows that had aborted the previous year	650

Of these six hundred and fifty cows, therefore, that aborted in 1865–66, and that were again in calf the following year, one hundred and forty-three, or exactly twenty-two per cent., aborted in 1866–67. But as the ordinary proportion of aborting cows in the State of New York is only a little over five per cent., it follows that a cow, after one abortion, is four times as likely to lose her calf the following year as if she never had been affected with the disease.

A point of some importance in the treatment of the cows is that relating to *the time at which the young calf is separated from its dam.* The practice varies somewhat in this respect. Sometimes, when the calf is to be raised, it is allowed to remain constantly with the cow for some days, and is afterward permitted to suck night and morning for six weeks or more. Sometimes it is permanently separated at from two days to three weeks; and in many instances it is taken from the dam immediately after birth, never being allowed to suck at all, and being either raised for a time on artificial food or killed at once for the skin, while all, or nearly all, the milk is retained for dairy purposes.

It has been thought that a too early separation of the calf might have an injurious effect upon the cow in predisposing her to subsequent abortions. Being at once deprived of her progeny, and prevented from exercising the ordinary functions of nourishing her young, the impression produced by this deprivation might affect the nervous system to such an extent that in subsequent pregnancies it might manifest itself by inducing abortion. In order to ascer-

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tain how far this might be the case, the proportion of farms in which the calves were habitually separated from the cows at an early day was compared with those in which the separation was deferred until a later period. The number of farms having over five per cent. of abortions in which the practice in this respect was reported, was 372; the number of those having not over five per cent. was 1,130. The result of their comparison was as follows:

Number of farms having *over* five per cent. of abortions (372) in which the calf is separated from the cow *within* two days after birth, 108, or twenty-nine per cent.; *after* two days, 264, or seventy-one per cent.

Number of farms having *not over* five per cent. of abortions (1,130) in which the calf is separated from the cow *within* two days after birth, 440, or thirty-nine per cent.; *after* two days, 690, or sixty-one per cent.

In those farms, accordingly, which have the smaller percentage of abortions, the calf is most frequently separated from the cow within two days after birth. So far as regards the liability to abortion, this result is favorable to an early separation of the calf, rather than to allowing it to remain with the cow for a longer period.

A fact of much interest has been developed in the course of the last few months, during the examination of the abortion returns, which deserves to be spoken of by itself; that is, the extremely *local character* of the malady and the narrow limits within which, in most cases, it is confined.

Early in the fall it was found, by a comparison of the farmers' reports received from Massachusetts, that there were several towns in that State in which the percentage of abortion was very high, and that these towns, in some instances, lay directly contiguous to others which were entirely free from the malady, or in which its percentage was so low as to be practically unimportant. Thus, in Worcester county, the town of Hardwick reported fifty abortions among two hundred and sixty-seven pregnant cows, or nearly nineteen per cent.; while in the town of Barre, next northeast from Hardwick, there were no abortions in a total of eighty-three pregnancies. The towns of West Brookfield and Brimfield, lying a little farther south, both reported abortions to the amount of over fifteen per cent.; while the town of Warren, situated between the two, had only four per cent. In the more eastern parts of the State, Shrewsbury, with forty per cent. of reported abortions, was

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contiguous to Boylston, with none at all; and Harvard, with eleven abortions out of fifteen pregnancies, lay next to Lancaster, with fifteen pregnancies and no abortions. In Greenfield, Franklin county, there were over twenty per cent. of abortions reported; and in the adjoining town of Shelburne only two per cent., and in that of Deerfield none at all.

It was hoped that by a careful inspection of these towns, so closely adjacent and yet so different in their percentage of abortions, some distinct peculiarities might be detected either in their physical situation, the quality of their soil, or in the breeding or treatment of their cattle, which might throw a valuable light on the causes, or at least the occasion of the malady.

Accordingly, Assistant Inspector Dr. Henry E. Handerson was deputed to visit the towns in question, situated in Worcester county, and to make of them a thorough and detailed examination, in order to determine the two following points, viz:

First—Whether these local peculiarities existed, in each case, throughout the entire township, or were confined to particular farms; and

Secondly—What was the apparent cause, either in the physical situation of the towns or farms, or in the breeding or treatment of the cattle, to account for such marked differences in the proportion of abortions in places so closely adjacent to each other.

Dr. Handerson performed this duty in a most faithful and judicious manner. He inspected the five towns of Hardwick, Barre, Oakham, New Braintree, and West Brookfield, and presented on his return a report embracing a large number of highly valuable facts and observations on the subject assigned to him for investigation. It was shown, in the first place, that a striking difference really existed in the abortion percentage of the above towns. Taking Dr. Handerson's report in connection with those previously received from the farmers, it appeared that in Hardwick there were one hundred and fourteen abortions among five hundred and eighty-seven pregnancies, or nineteen per cent. In the adjoining town of Oakham there were no abortions among seventy-nine pregnancies. In New Braintree, between Oakham and Hardwick, there were but twenty-three abortions in four hundred and sixty-seven pregnancies, or less than five per cent.; and in West Brookfield, next south of New Braintree, there were forty-one abortions in two hundred and eight pregnancies, or nearly twenty per cent.

An examination of the separate reports showed that the abortion

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malady was also very irregularly distributed among the different farms. In West Brookfield, for example, where the percentage of abortion for the whole town was higher than in any other, there were ten farms, reporting one hundred and seven pregnancies, or more than half the whole number, in which there was not a single case of abortion; while on three of the remaining farms the proportion was respectively twenty-eight per cent., thirty-four per cent., and fifty-six per cent. In New Braintree, with a general proportion of less than five per cent., there was one farm showing twenty-two per cent. and two farms showing fourteen per cent. each; while there were beside thirteen farms without a single case of abortion. It is not, therefore, the entire town which is infected with the abortion malady, but only particular farms situated within its limits.

Dr. Handerson says in his report, "In Oakham, I could find *no* well established case of the epidemic, either from report or from my own investigations. By reference to the rough map accompanying this report, it will be seen that the disease in Hardwick is principally confined to the southeast portion of the town. I do not intend by this that it does not exist in other portions of the town; but that elsewhere disease is the *exception;* in the southeast corner it is the *rule*. In West Brookfield two of the undoubted cases of the epidemic are in the northwest corner, just at the point nearest to the town of Hardwick. In New Braintree the disease is more sporadic, though still showing a tendency to aggregation. In Barre the only two undoubted instances of the disease are distant from each other perhaps a mile. In all the towns, infected and uninfected farms lay side by side; though this is less true in Hardwick than elsewhere."

The same thing is true in the State of New York. If we take Oneida county, where the average proportion of cases is three and a half per cent, we find that in three towns it is six per cent or over, and in nine towns it is less than two per cent. In Herkimer county, with a general proportion of five and a half per cent, the town of Newport gives eleven per cent, and the town of Fairfield twelve per cent; while there are four towns giving from five to eight per cent, and eight towns giving less than five per cent.

If we examine particular farms the difference is still more marked. In the town of Litchfield, Herkimer county, giving a general proportion of six per cent, there are three farms upon which the proportion is respectively forty-four per cent, forty-six per cent, and sixty-

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three per cent; while there are forty-seven farms upon which there is not a single case of abortion in 1,046 pregnancies.

In Winfield, Herkimer county, the general proportion is only two and a half per cent. But there is one farm where it is ten per cent, one where it is fourteen per cent, two upon which it is fifteen per cent each, and one where it is twenty-five per cent; while there are thirty other farms, giving altogether 687 cases of pregnancy, and no abortions.

In the town of Danube, Herkimer county, the general proportion is a little over five and a half per cent. There are, however, eight farms in which it is from two per cent to ten per cent, and eleven farms in which it is above ten per cent. Of these farms, one has thirty-six per cent, one thirty-eight per cent, one forty-five per cent, one fifty-two per cent, and one sixty-six per cent; while there are fifty-eight farms in the township which are entirely free from the malady, reporting altogether 1,635 pregnancies, and not a single abortion.

During a tour of examination made in Otsego county last summer, the Assistant Commissioner, Dr. Carmalt, inspected, among others, eight farms, situated in the towns of Springfield and Middlefield, and all lying within a space of two and one-half miles radius. No one of these farms had less than twenty-two cows in calf during the year 1866–7, and the average number for each was a little over thirty-two. In four of these farms there were no abortions in 141 pregnancies; one of them had six per cent. of abortions; and the remaining three had eighteen per cent. each. One of the farms, occupied by Mr. Theron Wickham, in which the abortions were eighteen per cent., is only half a mile distant from the "Gilchrist" farm, occupied by Mr. Erastus Hanor, in which there were no abortions. At a distance of one mile from the "Hyde" farm, the residence of the proprietor, Mr. Geo. Clarke, upon which there were no abortions, is the farm occupied by Mr. Albin Genter, in which the abortions were six per cent; and next adjoining the Genter farm, is that occupied by Mr. Abraham Woleben, upon which there were no abortions in a total of fifty-one pregnancies.

There are points in the previous history of these farms equally remarkable. The "Hyde" and "Gilchrist" farms, though now free from the malady, were affected by it from the year 1860–1 to about 1863–4; and during this period the abortions upon these two farms amounted to from seven per cent. to thirty-three per cent. of the pregnancies. The farm occupied by Mr. John Dutcher joins the

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"Hyde" farm on the south and the "Gilchrist" farm on the east; but upon Mr. Dutcher's farm there has not been a single case of abortion for the last fifteen years—the size of the herd varying from ten to thirty cows.

It is plain, therefore, that the malady of abortion, whatever may be its nature, is one which is extremely local in character—not extending in the same degree over wide tracts of country, but restricted within narrow limits in various localities. In other words, *abortion does not exist anywhere as an epidemic;* certainly not in the State, nor in any county of the State; nor even, so far as we have been able to ascertain, in any one of the towns. It is confined in the great majority of instances, to particular farms; and in these farms it appears and disappears, increases or diminishes, without reference to the condition of the herds upon other farms in their immediate vicinity.

This peculiarity in the distribution of cases of abortion was not anticipated at the commencement of the present investigation; and the commission cannot but regard it as an extremely important feature of the malady, and one which must be fully considered in any attempt to determine its nature and its cause. It explains why we have thus far failed to detect the cause of abortion in any of the general conditions of breeding or treatment which we have investigated. The occurrence of abortion does not seem to be regulated by any of these conditions; but appears to depend upon some cause which is much more local and limited in its operation.

As soon as this fact is established the idea naturally presents itself that we should endeavor to seek the cause of the difficulty in some physical peculiarity of the affected farms. If two farms lie side by side, in one of which abortions are frequent, while in the other they are rare or do not happen at all, may we not hope to find some decided differences in their situation, their high or low level, the character of their soil, or in the feeding or treatment of the cattle upon them, which may account for this variation in their results?

It was in order to ascertain this point, as already mentioned, that Dr. Handerson was directed to make a special inspection of the towns in Massachusetts where this strongly-marked local difference was first noticed. The result of his examination in this respect was very decided. Dr. Handerson speaks in his report as follows:

"The physical features of the five towns inspected are essentially the same. An endless succession of hills, more or less rocky, sep-

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arated by winding valleys, interspersed with numerous fresh-water ponds, make up the totality of the physical situation. Barre and the eastern portion of New Braintree are, perhaps, rather less hilly, but the difference in this respect is not very noticeable. The soil is generally a sandy loam, by no means productive naturally, and the timber is, in general, small and stunted oaks and pines. The farms are small, and the dairies average about sixteen cows only. Cheese factories have been introduced within the last two or three years, but are not nearly so numerous as in New York. In spite, however, of the unattractive physical features of this section, the farmers, as a rule, seem well-to-do and comfortably situated. The stock is also, as a rule, I think, better cared for than in the portions of New York which I have inspected. The practice of 'deaconing' calves, when one or two days old, is almost unheard of, the market for veal being always active and usually remunerative. Considerable stock is also raised, and farmers are thus led to take more pains in the improvement of the breed of cattle. Almost all the stock is more or less mixed with Durham blood. The hay of this section is inferior in quality to most of that fed in New York; and corn-fodder, straw, and husks of corn are fed to a greater extent. The stables are generally good, and, so far as my observation extended, are generally kept in good order. In other respects I do not know that the management of farms in Massachusetts differs essentially from the course pursued in this State.

"Turning then to the specific questions, the investigation of which was the direct object of my mission, I find them to be these:

"First, Whether these local peculiarities exist, in each case throughout the entire township, or are confined to particular farms; and, second, what is the apparent cause, either in the physical situation of the towns or farms, or in the breeding or treatment of the cattle, for such marked differences in the proportion of abortion in places so closely adjacent to each other?

"By the 'local peculiarities' referred to in the first question, I presume is intended the relative presence or absence of the disease. In reply to this question, I should say that none of the towns in this neighborhood, except Oakham, are entirely free from abortion; but that the disease is local, and that it is confined to a few farms in all of them, except Hardwick. Even in this town, as has already been stated, the principal violence of the disease is expended upon the southeast portion.

"In answer to the second question, viz., the cause of the disease,

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I must express my decided opinion that it does not depend, to any material degree, upon either physical situation, or the breeding or treatment of the cattle. Infected and uninfected farms lay side by side in almost every instance where I have met the disease. A marked example of this fact is seen in the condition of the farms in the northwest corner of West Brookfield. The physical situation of all these farms may be said to be nearly identical; yet uninfected farms exist there bounded on *both* sides by other farms upon which the disease rages with considerable violence. Moreover, that the disease is entirely independent of physical situation, is manifest from the fact that in those rare cases where the infected herd has been sold off entirely and replaced by healthy stock from a distant neighborhood, the disease has disappeared even upon the same farm. Such examples are very uncommon, but their testimony seems to me direct and positive. Are we then to look for the origin of the disease in the mode of breeding, or treatment of the cows? I must express my total inability to discern any appreciable difference in this respect between the healthy and the infected farms. That abuse of cattle will occasionally produce an abortion is very manifest, both from theory and the history of almost any inspected farm; but that even wholesale abuse will occasion the phenomena of this epidemic, seems to me inconsistent with both reason and fact, as recorded in my reports."

The assistant commissioner, Dr. Carmalt, was led to the same conclusion by the result of his special inspection of the farms of Mr. Geo. Clarke, in Otsego county, N. Y. I am authorized to say, that he could detect no decided peculiarities, either in the physical condition of contiguous farms, or in the daily treatment of the cattle thereon, which could account in any satisfactory manner, for the difference in their per centage of abortions.

It appears, accordingly, that the cause of abortion is local, and connected some way with the farm itself; and yet that it does not depend upon characters of physical situation, nor upon the details of breeding or treatment of the cattle. To what source, therefore, can it be attributed?

The commission would desire to speak upon this point with great reserve; since we do not believe that sufficient information has yet been obtained to warrant the expression of any decided opinion. Still it is thought that this portion of the subject should not be passed over in silence, as its mention may be of some practical benefit, and as the society has a right to all the information,

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however scanty, which the commisson may have succeeded in obtaining.

We would say, therefore, that there is evidence, to a certain extent that the malady of abortion is frequently brought into farms, in the first instance, by *importation*. It is not by any means certain that this is always the case; for there are some instances in which the disease has appeared without our being able to trace it to any external source. But there are also many cases of an opposite nature; and on the whole, the most noticeable general distinction between affected and unaffected farms appear to have been this: that the disease is more likely to show itself where the stock is habitually replenished by purchase from other farms, or from droves passing in the vicinity than where it is raised upon the farm itself, under the immediate care of the owner.

Dr. Handerson speaks on this point as follows:

"In all my investigations of the history of the epidemic upon special farms, I have avoided, so far as practicable, all leading questions, preferring to suggest little or nothing to the farmer's mind. My usual question was: 'Where did you get the first cow which aborted upon your farm?' The usual history of infected farms ran something like this: One or more abortions might have occurred at different periods within the last seventeen years, but no two in any one year, nor in any two successive years. These aborting cows were sometimes sold or killed, and sometimes retained, but no manifestations of disease followed. Finally within the last three or four years, a cow was bought, in calf, either from a farm, 'healthy, so far as known,' from a drove, or from a farm known to be infected. She aborts her calf; and if this takes place early in the fall, other abortions usually follow in the spring. But if this first abortion occurs in the spring, the other cows ordinarily carry their calves to full term for that year, but abort in the following fall and winter. Sometimes a single abortion only occurs for two successive years, and the presence of the epidemic is not manifested until the third year, when a number of abortions show the influence of the disease. In many cases, on endeavoring to trace the history of the farm, said to be 'healthy, so far as known,' from which the original aborting cow was obtained, I was unable to get satisfactory information, in consequence of frequent change of owners, or failure of memory on their part. In a few, no history of disease could be obtained; in quite a number, evidences of the disease had been manifested either before or very soon after the sale of the offending

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cow. The precise point, however, to which I wish to direct attention, is the comparative rarity of first abortions in cows *raised* upon the diseased farm. Auction sales of infected herds seem to have been fruitful sources of the disease. This fact, of the appearance of the disease upon a previously healthy farm soon after the advent of a cow from an infected farm, or from some farm whose previous condition cannot be ascertained, and this strange cow being the first to abort, is the chief peculiarity which has been observed in the history of the disease. Many instances of this kind will be found in my reports, and I will only refer to the reports of Mr. Delahunty, of West Brookfield; Messrs. Wilcox, G. N. Bush, and Joseph Woods of New Braintree; Calvin Mann, J. W. Powers, and Frederick D. Ruggles, of Hardwick, and Lemuel Rice, of Barre.

"Upon the farm of Mr. Calvin Mann, above referred to, in the year 1866–67, there were eight abortions among nineteen pregnancies, or forty-two per cent. The disease had first appeared in the previous year, viz., 1865–66; when there were four abortions in eighteen pregnancies, or twenty-two per cent. The first cow which aborted had been obtained by exchange from Mr. Dwight Fisk, who had the disease upon his farm at that time. Mr. Fisk stated that he, in his turn, first got the disease from a cow which he had bought in December, 1864, from another farm then occupied by Mr. Mann, and upon which four abortions occurred that year.

"On the farm of Mr. J. W. Powers, in 1866–1867, there were four abortions in twelve pregnancies, or thirty-three per cent. In the year 1865–66, there had been seven abortions in eight pregnancies, or eighty-seven and a half per cent; and in 1864–65, the first year of the disease, there were two abortions in fifteen pregnancies, or thirteen per cent. Previously to that time there had been no abortions for at least fourteen years. The report states that "most of the cows upon this farm have been bought. They have usually been driven to neighbors' bulls. The first cow which aborted (in 1864–65,) was bought in December, 1864, of Mr. Calvin Mann, who had the disease upon his farm at that time. She aborted in the following January, and in another month a second cow, bought at the same time and place, also aborted. Both these cows were fatted and killed; one in April, 1865, and one in the fall of the same year. The first cow which aborted in 1865–66, had been raised upon this farm, and served by a bull from a healthy farm.

"On the farm of Mr. Wm. Delahunty, there were in the year 1866–67, nine abortions in twenty-five pregnancies, or thirty-six per

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cent. The disease had also appeared the previous year, viz: 1865–66, when there were five abortions in eighteen pregnancies, or twenty-eight per cent. The report states as follows:

"'Mr. Delahunty bought this farm in August, 1865, of Mr. Sidney Adams. Two cows, already in calf, were bought upon the farm, and in the following November, Mr. Delahunty moved all his stock down to this farm. In January, 1866, one of the two cows which had been bought with the farm, aborted; and soon afterward the other purchased cow, and *three* of Mr. D's own stock also aborted. Mr. D. has since been told by the former owner, that abortions had occurred upon this farm before the time of its purchase by him. Of the nine cows that aborted in 1866–67, Mr. Delahunty has sold all but one; this one is still on the farm and has not yet aborted, though now in the eighth month of pregnancy. Since May, 1867, Mr. Delahunty has had four abortions, all occurring in cows bought this year, all coming from separate towns, and from farms upon which no disease existed, so far as known.'"

Dr. Carmalt's special report of his inspection in Otsego county, shows some important facts of a similar nature. This inspection was made upon thirteen farms, all belonging to the same proprietor, Mr. George Clarke, and situated in the towns of Springfield, Middlefield, Cherry Valley and Milford; eleven of them being leased to tenants, and the remaining two conducted under Mr. Clarke's immediate supervision. It was upon these farms that the disease first made its appearance in Otsego county, and Dr. Carmalt directed his attention especially to them, because he hoped that it might thus be possible to determine the origin and trace the cause of the disease with more certainty than elsewhere, where farms are each owned by a separate person, farming it himself and having indefinite relations, in regard to changes of stock, with his neighbors.

The history of the malady upon these farms, as given by Dr. Carmalt in his report, shows the following facts:

"According to the statements of Mr. Clarke, Andrew McLean, and W. M. Smith, abortions first occurred among Mr. Clarke's herds, at the 'Gilchrist' farm, in July, 1860, during which year thirty-three per cent. of the pregnant cows were affected. Two or three of these aborting cows were thoroughbred Herefords. The others were grade Herefords; and all were large, well nourished, and otherwise healthy animals. More or less changes were always taking place previous to this sudden eruption of the disease; but it was not thought that any cows had been introduced from a dairy

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or district where abortions were prevailing. Indeed, this was the first appearance of the disease affecting a herd generally anywhere in this section, so far as I could learn; nor could I trace anything that would seem to be a sufficient cause to produce it in this way in an apparently perfectly healthy stable and herd. The bull 'Cronkhill,' who got the aborted calves, was a thoroughbred Hereford that had been used for some years by Mr. Clarke, and, I believe, raised by him, and was a large, strong, healthy animal. There had been no changes introduced in the manner of stabling or feeding; and, so far as I could learn, the hay was of the same kind and quality, and cured as usual.

"The following year, 1861, the disease affected this herd again, six abortions occurring out of a herd of forty, or fifteen per cent. From that time down to last year the disease had gradually decreased until it ceased altogether, and this year the farm is entirely free from it.

"The year following the first outbreak of the disease upon the 'Gilchrist' farm, *i. e.*, in 1861, it appeared at the adjoining farm of 'Hyde,' five cows aborting out of a herd of fifty, or ten per cent. There had always been more or less intercourse between these two stables and herds. The next year ten abortions occurred out of a herd of seventy-three. The two following years five or six calves were lost, the size of the herd remaining about seventy. The disease then disappeared from this farm, and has not shown itself there again.

"Upon the farm occupied by John McCarthy, situated about one mile to the eastward, the disease appeared in 1862, two abortions occurring out of a herd of forty. One of these aborting cows had come from the 'Hyde' farm. The following year six cows out of thirty-four were affected, and the loss has continued about the same ever since. The occupant of the farm has always endeavored to get rid of an aborting cow, and to fill up by purchase, either from the neighbors generally, or from some other of Mr. Clarke's farms.

"About one mile from McCarthy's is the farm cultivated by Joseph Hoey, who has held possession since 1860, but who escaped the disease until 1865-66, when he lost eleven calves out of a herd of twenty-one; and this year, 1866-67, he has lost six out of twenty-two. He has had cows from Hyde at various times, and reports that until two years ago he bought into and sold cows from his dairy whenever he needed them.

"A little over a mile from Hyde is the farm occupied by

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Abraham Woleben, who has been upon it since 1852. He has kept about thirty-five cows until 1861, when his dairy was increased to about 50; getting an increase of stock in part from Mr. Clarke, and in part elsewhere. He has only had occasional abortions, which he always thought could be traced to injuries received. He has always raised his cows from calves upon the place, and has tried to improve his stock for his own use.

"On the farm cultivated by John Dutcher, in Springfield, there has been no case of abortion for fifteen years, although it lies contiguous to both the "Hyde" and "Gilchrist" farms. The cows are all raised upon the farm from calves, and have always remained there. Mr. Dutcher has tried to improve his stock by using thoroughbred or highly graded bulls, and keeping his best heifers and cows for breeding; and he has allowed but little and only casual intercourse with his neighbors's herds.

"Upon the farm cultivated by Lucian Hinds, about the year 1864, there were twenty abortions among fifty cows. All these twenty aborting cows had been brought from another farm some miles distant, upon which abortions had been troublesome for some years past. Since that time the disease has increased, and during the year 1866–67 there were twenty-six abortions out of thirty-four pregnancies, or over seventy-five per cent. Mr. Hinds raises no calves to keep up his dairy, but buys all about the country.

"In the town of Middlefield is the farm cultivated by Mr. Daniel Leonard. He has never had an abortion on his farm. He has raised his present stock himself, and does not purchase his dairy cows at all. His bulls have generally been half-breeds of different kinds at present half-bred Ayrshires, and are kept separate from the cows. * * * * * * * *

"In reviewing the reports of these different farms, it will be seen that upon seven of them the disease has appeared with considerable severity, and in successive years; while of the others, four have entirely escaped, and one has for the first time this year had two abortions, both of which were of doubtful nature.

"All seven of the herds included in the first list have been made up by purchases about the country at large, and have afterwards been subjected to continued changes among themselves; while in the remaining five, nearly all the cows are reported to have been raised on the place, or subjected to but one removal, and have been kept continuously upon the same farm for a number of years.

"While from this classification I am not prepared to say that if a

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cow be kept on one farm all her life, she will not abort, nor if a cow be subjected to many changes of residence or companions, that she will abort; yet it does seem fair evidence, so far as a limited number of cases may be relied on, that the number of abortions in any given herd is increased by such continual changes; and it should also have some weight in considering the best means of preventing the recurrence of the malady."

This finishes the evidence on the subject of importation. It will be seen that the Commission has obtained no information in regard to one of the possible sources of abortion suggested by the society, viz.: the occurrence of ergotized grass, or other deleterious plants, in the food of the affected cattle. No attempt has been made in this direction, for the reason that it was thought that such inquiries would not be attended with advantage, until we had acquired a more definite knowledge of the particular location of the disease.

The results obtained by the commission, so far as it has been able to extend its investigations, may accordingly be summed up as follows:

1. Abortion exists, as a serious malady, in some parts of New York and Massachusetts, and in one or two localities in Pennsylvania. It is very rare, or entirely absent, in Ohio, Illinois, Michigan, and Iowa.

2. In New York the annual number of abortions among cattle has considerably increased since the year 1860–61. At present the number of abortions for the entire State is about five per cent. of the whole number of cows in calf.

3. Abortion is not proportionate in frequency to the quantities of butter or cheese produced in the affected districts.

4. It is not more prevalent among good milkers than among ordinary milkers.

5. It is not more common in first pregnancies than in subsequent ones.

6. It happens most frequently in the sixth, seventh, and eighth months of pregnancies, and in the months of December, January, and February.

7. In all probability, it is not due to exposure to cold or to insufficient stabling of any kind.

8. It is not more prevalent among cows impregnated at the age of one year or eighteen months than among those impregnated at a later period.

9. It is more frequent among cows which have been impregnated

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by two or three year old bulls than among those impregnated by yearling bulls.

10. It is not due to inflammation of the uterus, nor to any marked change in the generative organs, other than a stoppage of the circulation and arrest of development.

11. It is probably not owing to any defect in the original formation of the fœtus.

12. Aborting cows are more liable to abort the following year than others which have never been affected.

13. The early separation of the calf from the cow does not seem to have any injurious influence in producing subsequent abortions.

14. Abortion is a disease which is extremely local in character, and confined, for the most part, to particular farms.

15. The large majority of farms, even in the affected districts, are free from the disease, while upon a few farms the percentage of abortion is high, and the disease destructive in its effects.

16. Affected and unaffected farms often lie mingled together in close proximity, there being no marked difference in their physical situation or in the treatment of their cattle to account for the difference in the prevalence of abortions.

17. It is probable that abortion is, in many instances, imported into the affected farm by cows purchased while in calf, coming from infected districts, or even from localities where the disease is not known to exist.

At the request of the Society, we have also made inquiries in regard to the practice of *spaying* cows, and the effect of this operation upon the duration and quantity of the milk supply. The result of this investigation, however, has been entirely negative. Inquiries were made by the inspectors upon 871 farms, situated in thirty-eight different towns, in the counties of Oneida, Otsego, Herkimer, Lewis and St. Lawrence; and in no instance did they find that the operation of spaying had been put in practice upon the inspected farms.

The expenses of the commission have been as follows:

Printing and stationery	$380 45
Postage	549 00
Express charges and telegrams	9 18
Maps and diagrams	44 27
Cow for post mortem examination	20 00
Salary of assistant inspectors for fifteen and a half months, at $100 per month	1,550 00
Current expenses of the above	1,691 72
One assistant inspector on special duty	150 00

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Current expenses of the above	$78 64
Traveling expenses of the commissioner	16 50
Traveling expenses of the assistant commissioner	36 51
Two acting assistant inspectors, half a month each	100 00
Salary of assistant commissioner, nine and one-half months, at $1,000 per year	791 00
Total	$6,417 27

The gentlemen who have acted as assistant inspectors under the commission, have performed their duties with great industry and fidelity, visiting a wide extent of country, and doing a large share of continuous and fatiguing labor. The especial acknowledgments of the commission are also due to the assistant commissioner, Dr. Carmalt, without whose aid it would have been impossible to arrange and tabulate the large quantity of material comprised in the separate reports. Respectfully submitted,

J. C. DALTON, M. D., *Commissioner.*

(A.)

REPORT OF THE

Farm cultivated by Mr. in the town of , county of State of

Number of calves born alive at full term, from May 1, 1866, to May 1, 1867..

Number of abortions occurring, from May 1, 1866, to May 1, 1867.....

Total number of cows in calf, from May 1, 1866, to May 1, 1867.....

	Breed of Cows.					
	Devon.	Short-horn.	Ayr-shire.	Alder-ney.	Native.	Total.
Number of cows that carried calf to full term.....						
Number of cows that aborted.						

Number of Abortions Occurring in the

First month of pregnancy .....

Second do do .....

Third do do .....

Fourth do do .....

Fifth do do .....

Sixth do do .....

Seventh do do .....

Eighth do do .....

Ninth do do .....

Total .....

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NUMBER OF ABORTIONS OCCURRING IN THE MONTH OF

May .....
June .....
July .....
August .....
September .....
October .....
November .....
December .....
January .....
February .....
March .....
April .....

Total .....

DESCRIPTION OF BULLS USED FOR SERVICE.

	Breed.	Thoroughbred or mixed.	Age. (Years.)	Weight. (Pounds.)
Bull No. 1 ..... Bull No. 2 ..... Bull No. 3				
In case only one bull was used, place the description after "Bull No. 1."				

NUMBER OF COWS IMPREGNATED BY

	Bull No. 1.	Bull No. 2.	Bull No. 3.	Total.
That carried calf to full term ... That aborted				

NUMBER OF COWS THAT WERE

	Good milkers, giving more than 460 gallons per year.	Ordinary milkers, giving less than 460 gallons per year.	First pregnancy.	Total.
That carried calf to full term ..... That aborted				

Number of aborted calves born dead or diseased looking .....
Number of aborted calves born alive and healthy looking, according to age .....

Total .....

Number of aborting cows that were sick immediately before, during, or after abortion .....
Number of aborting cows that were *not* sick immediately before, during, or after abortion .....

Total .....

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What symptoms does the cow exhibit when sick before, during, or after abortion, as to appetite, emaciation, stupor or restlessness, unnatural discharges, or other particulars?

PREVIOUS HISTORY OF THE EPIDEMIC UPON THIS FARM.

(Carry the record back as far toward the year 1850 as it can be done correctly.)

From May to May in the year	Number of calves born alive at full term.	Number of abortions.	State below whether any changes, and if so, what, have been made during this period in the breed of cows used, their feeding, stabling, or other treatment, or in the kind of bulls used for service, or any other particulars, and at what time such changes were introduced.
1850–51			
1851–52.....			
1852–53.....			
1853–54.....			
1854–55.....			
1855–56.....			
1856–57.....			
1857–58.....			
1858–59.....			
1859–60.....			
1860–61.....			
1861–62.....			
1862–63.....			
1863–64.....			
1864–65.....			
1865–66.....			

Have the cows on this farm ever died in consequence of abortion; and if so, how many, and in what years?

Are the cows on this farm used for producing milk or for stock raising?

How soon after birth is the calf separated from the cow?

In what month of pregnancy are the cows dried off from milking?

At what time in spring are they turned out to pasture?

At what time in fall are they stabled?

Is the pasture amply provided with shade for cows?

Is the pasture amply provided with water accessible to cows?

How far from the stables to pasture?

Are the stables above or below ground?

Are the stables dark or well lighted?

Are the stables well or imperfectly ventilated?

Are the stables comfortably warm in winter?

Are the cows in winter allowed to roam in stable yard during the day, or confined in the stable?

If confined, how often, and for how long are they let out into yard?

While in stable, how are they fastened in the stall?

How many feet of space, from side to side, allowed to each cow?

Is the stable yard amply supplied with water accessible to cows?

Upon what kind of hay are the cows fed?

Is the hay raised on the farm or purchased, and if so, where?

How much salt is given, and how often to each cow?

What root crops given, and how much to each cow?

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What ground feed given, and how much to each cow?
Are the pregnant cows fed on their own buttermilk or cheese-whey?
If so, which, and how much daily to each cow?
Date, , 1867. (Signature.)

(Please answer all the above inquiries so far as practicable, whether you have had any cases of abortion or not; as negative replies are equally valuable in this investigation with those which are affirmative.)

(B.)
ADDITIONAL REPORT OF THE

Farm cultivated by Mr. , in the town of , county of , State of

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At what age are the cows on this farm usually impregnated for their first pregnancy?

Of all the cows on this farm, in the year 1866–7, *that carried calf to full term—*
How many were cases of first pregnancy?
How many had borne a calf at full term the previous year?
How many had aborted the previous year?
Total.

Of all the cows on this farm, in the year 1866–7, *that aborted—*
How many were cases of first pregnancy?
How many had borne a calf at full term the previous year?
How many had aborted the previous year?
Total.

How many calves born on this farm in the year 1866–7, are still alive?
How many were killed?
How many died from debility or disease?
Total.

How many cows in all were served during the year 1866–7, by bull No. 1?
do do do do do do 2?
do do do do do do 3?

(Ascertain the above facts by inquiring of the owner of each bull.)

How many cows, altogether, on this farm have been subjected to the operation of *Spaying*?
How many died from the operation?
How many survived the operation?

Of those that survived—
How many ceased giving milk immediately after the operation?
do do do within 1 year do do
do continued to give milk for 1 year do do
do do do do 2 years do do
do do do do 3 years do do
do do do do 4 years do do
do do do do 5 years do do

(Insert here any further information which may be obtained in regard to the above subject.) Date, 1867.
(Signature) M. D., *Assistant Inspector.*

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EULOGIUM

ON THE LATE

GOVERNOR JOHN A. KING,

DELIVERED

BY JOHN STANTON GOULD.

Mr. President and Gentlemen:

Since our last annual festival at Saratoga one who was then with us, who has long shared in our councils and participated in all our joys and sorrows, has gone from us to be seen no more.

> "Oh, thicker, deeper, darker growing,
> The solemn vista to the tomb,
> Must know henceforth another shadow,
> And give another cypress room."

Our religion does not forbid us to mourn when the great and good men whom we have loved and honored in life are removed from us by death. The Founder of that religion wept beside the tomb of the friend He loved, and all His teachings while on earth sanctioned and encouraged not only the inward feeling, but the outward expression of the deepest emotions of human sympathy and love. The teachings of philosophy unite with the sanctions of religion, and bid us cherish the memories of the departed with jealous care, considering the history of their lives as it gradually evolved, and drawing from it precious lessons for the regulation of our own conduct.

We may not, indeed, sorrow as those who have no hope; we may not repine as though the privation we have experienced was an invasion of our rights; but we may linger lovingly around the tomb of departed worth, and enshrine their memories in our affections and our hearts.

Our departed ex-president and friend, Governor John A. King, was born in the city of New York on the 3d day of January, 1788.

His father, Rufus King, was one of the conscript fathers of the republic, and bore one of the noblest names in our early history. Born in 1755, at Scarborough, in the then district of Maine, he graduated at Harvard College in the year 1776, and after studying the law he was admitted to the bar in 1778. Rising rapidly in his

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profession, he soon secured an extensive and lucrative practice, and so closely had he intrenched himself in the respect and confidence of his fellow-citizens that he was elected as a member of the Congress of the Confederation six years after his admission to the bar, at the early age of twenty-nine years; and was subsequently elected a member of the convention of Massachusetts by which the Constitution of the United States was ratified.

In 1788, he removed to the city of New York, and was elected to the Senate of the United States from thence in the year 1789, together with General Philip Schuyler. He continued a member of that body until 1796, when he was selected by General Washington to represent our Government at the Court of St. James, where he remained until 1803; having declined the invitation of Washington to fill the office of Secretary of State. In 1808 he was the candidate of the Federal party for the office of Vice President. In 1813 he was again elected to the Senate from the State of New York, where he took a leading part in the debates upon the Federal side. In 1816 he was the candidate of the Federal party for the office of President, and received thirty-four votes for that office to one hundred and eighty-three given for James Monroe of Virginia. In the Senate he took firm and decided ground against the slave trade, and in favor of restricting the State of Missouri from permitting slavery within its limits. Having been re-appointed Minister to England by President J. Q. Adams, his last act in the Senate was to offer a resolution devoting the public lands of the United States, as fast as they were sold, to the formation of a fund which should be sacredly applied to the emancipation of slaves owned in the United States, and to their removal to territory without its limits. He only remained about a year in London, where his health was so much impaired that he was compelled to resign and return to his home in New York, where he languished for some time, and died in the year 1827.

He opposed with all his wonted energy and eloquence the declaration of war against Great Britain in 1812, but when he was overruled, and the voice of the nation pronounced through its constituted authorities in favor of the war, he voted generously for the men and money required to carry it on, and cheerfully gave all his influence and ability to sustain the Government while it was being waged.

His eloquence was of the highest character, and made a deep impression on his auditors. His person was symmetrical and com-

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manding. He always appeared in the Senate in a full dress, short small clothes, silk stockings and shoes, and was habitually observant of all the courtesies of life, and was especially graceful and agreeable in his intercourse with ladies. He did not allow himself to be approached with the free and easy familiarity of our times, but kept up those barriers to social intercourse which the etiquette of those times prescribed. Among his advantages as a public man, was an accurate knowledge of facts and dates, which he could state with such oratorical adornments and with such rotund elocution as always commanded the wrapt attention of his auditors. His two finest speeches are said to have been on the burning of Washington by the British, and on the exclusion of Mr. Gallatin from the Senate. The speeches upon which his fame as a statesman must chiefly rest, are those which he made on the Missouri controversy. His private life was worthy of his public fame, both being alike irreproachable.

I have dwelt thus long on the conduct and career of the father, because it is the best possible preface to the life of the son, whose character it is our especial business to consider. The life of Gov. John A. King was admirably adumbrated by that of his father. The seeds of political principle which had germinated in his mind and were advancing to maturity, seemed transplanted into that of his son, where they continued to grow as in a fertile soil until they reached a ripe and perfect fruitage. The one seemed to be the complement of the other; the father, amid obloquy and scorn, labored to sow broadcast the seeds of liberty in the land; but after all the toils and vicissitudes of a life devoted to the service, his eyes were not cheered with any evidence of success. So far as he could see, he had lived in vain. The shackles had indeed fallen from the limbs of the slaves of New York, but the accursed system had extended in a geometrical rate of progression in the States which we had acquired by purchase from France and Spain and the owners of slaves daily increased in their aggressive demands, while Northern doughfaces as regularly violated their consciences by acceding to them.

Governor King saw as clearly as any one the apparent hopelessness of the struggle; yet, to his eternal honor be it spoken, he was not dismayed. He was faithful among the faithless, and cheerfully gave all the years of his manhood to battle for the cause of truth and righteousness.

Undismayed by slaveholding arrogance, by the faithlessness of false brethren, or the weak minority that supported him, he believed

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that his cause was the cause of God, and that labor for its promotion was its own exceeding great reward.

> "Then to side with truth is noble, when we share her wretched crust,
> Ere her cause brings fame and profit, and 'tis prosperous to be just;
> Then it is the brave man chooses, while the coward stands aside,
> Doubting in his abject spirit, till his Lord is crucified,
> And the multitude make virtue of the faith they have denied."

Yet it was given to Governor King, ere his every sun had sunk behind the hills which separate our existence from the land of the hereafter, to know with certainty that the blows on behalf of liberty which had been given with so little apparent purpose by his father and himself were *not in vain*, but that their purpose had been accomplished and the victory was won.

He saw the pomp of the processions which brightened our whole land with splendor; he heard the glad ringing of the joy bells and the triumphant roar of the cannon which announced our final victory over the foe and the breaking of the shackles of the slave; and then, as was fitting, his work being done here on earth, he went to join his revered father, whose example he had followed, to the better land where toil and conflict are alike unknown.

Let the young farmers of New York ponder well upon the lesson which is taught from the tombs of this father and this son; let them never be discouraged by the lack of present success; but, knowing that God is ever on the side of his own truth, let their faith be strong that in His own time and in His own way He will honor them with the victory and the crown.

> "Careless seems the great Avenger; history's pages but record
> One death grapple in the darkness, 'twixt old systems and the Word;
> Truth forever on the scaffold, Wrong forever on the throne,—
> Yet that scaffold sways the future, and, behind the dim unknown,
> Standeth God within the shadow, keeping watch above His own."

It is easy to see how the life and the aims, the associations and the employments of such a father must re-act upon the character of the son. The school, the college, the pulpit and the press all exercise a great and acknowledged influence upon the mind of the boy; but none of these, nor all of these conjoined, have so potent an influence in moulding his future destiny as the steady pressure of the words he hears and the sights he sees around the paternal hearth-stone. When the father and the mother are educated and polite, as are their habitual visitors; when they invariably exhibit a spirit of reverence for real worth; when every phase of feeling is represented by its appropriate tone and gesture; when a spirit of

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perfect justice to every member of the household, both great and small, reigns supreme throughout the habitation; when gossip and scandal are rigidly prohibited in social intercourse; when noble themes, worthily discussed, are the constant topics of conversation, and especially where God is reverently worshipped and his word is daily read, we may be sure of the type which the character of the boy will assume.

Governor King drew his earliest breath and received his earliest culture in the bosom of such a family. His first memories were of the wisest and noblest men that our country ever produced as the habitual visitors at his father's fire side. The noble form and stately presence of Washington, the subtile intellect of Hamilton, the manifold culture of John Adams, the burning eloquence of Fisher Ames, the shrewd sagacity of Roger Sherman, the calm judgment of Marshall, and the inflexible integrity of John Jay, all surrounded him in his early youth and conspired to direct his mind into the channels of thought and action which, in after years, he was engaged in with so much honor to himself and so much benefit to the community.

The conversation and the example of such men could not do otherwise than prompt him to noble aims, to a love of sound principles and to strenuous efforts for improvement.

He received a rudimentary education at the schools of his own country, but going with his father to England, he was sent to the celebrated school at Harrow, in 1797. Here he was the companion of Lord Byron, of Sir Robert Peel, of the Duke of Devonshire, and of many others, who, at a subsequent day, inscribed their names high on the roll of fame and received the admiring plaudits of their grateful countrymen. The English boys are a pugnacious race, and the patricians are quite as much so as the plebians; no one can obtain a position that he does not fight for, he is allowed to wear no laurel that is not fairly won.

Our young American was thus fairly put upon his mettle. He was to satisfy the young aristocracy of England, whether their race had degenerated under Occidental skies, or whether it retained its pristine vigor.

Young King did not suffer in the trial. He was naturally athletic and active, and though at first he was lacking in science and suffered some severe bruises, yet it was not long before his Yankee ingenuity enabled him to acquire all the mysteries of boxing, and he thenceforward became a leader in all the physical exercises practiced at

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the school. The effects of this physical training never left him. After he had passed his seventieth birthday, in the presence of many of his brethren of the Executive Committee, he put his hand on the top of a fence, and vaulted over it with the agility of a boy, playfully reproaching his companions for their laziness in climbing over it. He maintained a good standing in classical learning, and though he never took the highest position, he was very far above the lowest. The Governor always retained a strong affection for this school, and always numbered his connection with it as among the especial blessings of his life.

After he had gone through all the classes at Harrow, he was transferred to a celebrated school in Paris, where he perfected himself in the French language and applied himself to the study of the physical sciences, which were then very much neglected in the great schools of England.

A very friendly feeling existed at that time in France towards America, which manifested itself unmistakably in social life towards all Americans of respectability; but from the high character and position occupied by his father, Mr. King received a double portion of attention from the eminent men who surrounded Napoleon, who was then in the zenith of his glory. The systems of policy which found expression in the Berlin and Milan decrees were then under discussion at Paris, which had the effect of turning his attention to the subject of the rights of men and nations, and probably laid the foundation for that vivid interest in political affairs which he ever afterwards cherished to the latest period of his life.

The equality of all men before the law in Paris, and the genial courtesy of Frenchmen of the highest rank to their inferiors in social position, won his highest admiration, and modified his principles and practices in that direction. I believe no public man in the State of New York ever treated the poorer and uncultivated classes with such uniform and heartfelt kindness of manner as himself. If he had acquired anything of the stiff and overbearing manner of Englishmen during his residence at Harrow, it was effectually removed by the genial society of Paris, and was never afterwards resumed.

On the termination of his studies in Paris he returned to his native country and entered the office of Judge Pendleton, where he studied law with much assiduity and success.

In 1809 he was admitted to the bar, and entered industriously on the practice of his profession; but his time was not so fully

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occupied with the duties of his office as to prevent him from a most faithful attention to one of his lovely and accomplished clients in her own parlor, which finally resulted in his entering into a matrimonial partnership with her in the year 1810. She was the daughter of Cornelius Ray, a wealthy gentleman of the city, and the union thus formed proved the sweetest solace of his life.

In the year 1812, war was declared against Great Britain. We have already seen that Rufus King opposed this war with all his might as long as he considered that there was any possibility of averting it, but when it actually came upon us, he devoted all his energies to secure success to our arms. His son faithfully followed his example. No sooner had war been declared than he sought and obtained a commission as Lieutenant in a company of Hussars, which served as a body-guard of Gov. Daniel D. Tompkins, who, in addition to his civil office, was commander of the United States troops in and around the city of New York. He continued faithfully to serve his country in the field until peace was declared in 1815, when he resigned his commission and returned once more to the pursuits of civil life.

Governor King had always felt an inward vocation for rural life; he loved the song of birds and the odor of the hay field; he delighted in the solemn umbrage of the woods and keenly relished rural sports. His professional business had been broken up by his military career, and he therefore decided that the period was propitious to the change in his pursuits, which he had long contemplated to take effect at some period in the future. He accordingly purchased a farm in the vicinity of that of his father at Jamaica, and at once devoted himself to the active duties of agriculture. Here, as his friends have often heard him say with deep feeling, the happiest ten years of his life was passed.

His circumstances at this time were but moderate, and he could not afford to lead an idle life; he therefore applied himself to the cultivation of his land with characteristic energy. He was not a fancy farmer, but a practical one, working in his fields with all the intelligence and strength that he was possessed of. There was no work on the farm that he was not skilled in, and none that he could not and did not perform in his own proper person and with his own hands. Rising early and working late and industriously, he plowed, sowed and reaped, and always in mowing he took the leading swarth in the field at the head of his mowers, and was quite satisfied with their services if they kept up with him, and performed

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the same amount of labor that he did. He assisted in putting up his own fences and outbuildings, and the picket fence around his pleasure grounds was built entirely by his own hands.

In those days fox hunting was a favorite amusement among the gentlemen of Long Island, and Gov. King being a fearless and graceful rider, was often at the meet, mounted on a favorite mare, and he generally contrived to be in at the death. From this mare he raised several Bussorah colts, which he trained, bitted and broke himself, so that they would follow him like dogs wherever he chose to lead them, and all the horses thus trained by him proved eminently serviceable for the saddle. There was, in fact, nothing connected with a farmer's life which he did not cheerfully and eagerly pursue, using withal a careful economy, which was essential to his pecuniary success.

There were not wanting those among his wealthy aristocratic friends, who felt it necessary to apologize for a man of his birth, breeding and culture, who engaged in the homely labors of agriculture, and worked with his own hands; such apologies always excited his ire, and provoked a hearty and outspoken expression of his opinion that agriculture was the noblest occupation of man, which no man should be ashamed of.

He found time during their proper season and when not pressed by his crops (the tillage of those days being different from the present), to enjoy his gun and sporting dogs; being a keen and good sportsman he took great delight in beating up the game then abundant on Long Island, in company with his friends, when they came into the country for relaxation. In the spring, the trouting streams, and in the autumn the bays, each of which were within an hour's drive, would afford ample use for his rod and fowling piece.

From early manhood he was a devoted lover of the turf, and rarely omitted at the spring and autumn meets to be at the Union Course, which was about four miles from his home. Many of his old personal friends took an interest in importing and breeding fine horses, and formed a Jockey Club, of which he was a member, and of which he was for many years the president. Indeed, he only ceased to fill that office when his friends retired from it, and the club was broken up. His scrupulous and inbred delicacy of feeling was manifested in his conduct while he held this office. He rarely made a bet, and then only for a trivial sum, as he deemed it the duty of the president to abstain from betting, even if he had the desire to make the wager, as many delicate questions must be brought

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before him as umpire. He loved the race-course wholly for the useful results which he believed had flowed from it, and for the beauty and grace of motion exhibited by the competing animals; but he took no pleasure in the gambling excitements which are too frequently associated with the turf. He was the owner of several young full-blood fillies, but never entered either of them for a race.

From early life Governor King had taken a deep interest in political affairs, and while he was a lawyer, as well as after he became a farmer, he was in the habit of addressing his fellow-citizens at their primary meetings and conventions upon subjects of political interest which evolved out of the exigencies of the times. His captivating eloquence, his steady adherence to fixed principles, and the daily beauty of his life had steadily won on the affections of his fellow-citizens until a growing desire which had for some time been in progress culminated in his election to represent them in the Assembly in the year 1819, Dewitt Clinton being the Governor. He was re-elected in 1820 and 1821, and in 1823 he was elected to the Senate from the old Second senatorial district, Erastus Root being the Lieutenant Governor and President of the Senate, and Joseph C. Yates being the Governor.

This period of his legislative life was marked by sturdy contests respecting the canals. Indeed, the canal question was the one great issue upon which all other political questions hinged.

With a clear and prophetic foresight of the priceless wealth which their construction would cause to be poured into the lap of New York, he never hesitated in the support which he gave to the policy which Mr. Clinton had inaugurated; some of his finest speeches were made on its behalf; and it may be added that he never swerved from the principles of internal improvement, which he advocated in the morning of his life, to the latest hour of his existence.

Such was his mode of life from 1815 to 1825, and such it probably would have continued to be for a much longer time if he had not deemed it to be his sacred duty to accompany his aged father on his second mission to England, to which he was appointed in 1825 by John Quincy Adams. He filled the office of Secretary of Legation under him, and after a year spent in that position he was appointed *Charge d'Affairs* until the arrival of Mr. Barbour, his father's successor. I have often heard him in his rich and unctuous manner describe the scenes which he witnessed during his residence at the Court of Great Britain during this period, and I deeply

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regret that I have preserved no written memoranda of them; but as so many of my auditors have listened to the same stories from his lips, there is the less necessity for their repetition here.

I remember once of his giving an account of a grand state dinner which was given shortly after his father's arrival in London, and to which he was invited as the representative of America. On the morning of the day when the dinner was to be eaten his father was seized with a violent fit of gout, which was so severe as to confine him to his bed, and it was therefore impossible to attend to the dinner. An apology was despatched at once for his absence, and no farther attention was paid to the matter. But after a little while a note came back expressive of the deepest regret for the sudden illness of the American Minister, but expressing so strong a desire that the Secretary of Legation should represent him at the table that it amounted almost to a command, and it could not be evaded without positive discourtesy. The Governor's description of his embarrassment at the reception of this peremptory invitation was exceedingly amusing.

He was about to appear among the first men in Europe; there was no time for inquiries respecting the etiquette observed on such occasions, no time for the preparation of a speech or even for the selection of suitable topics; hardly was there time to dress; he was compelled to go there just as he would if he was going to dine with one of his neighbors at Jamaica. All this made him feel excessively nervous, lest he might commit some solecism of manner or of expression, which in the eyes of those who did not know the peculiar circumstances under which he went there might appear ridiculous or odious.

But on entering the room the first person he encountered was a distinguished duke who had been his school-fellow at Harrow, who met him with so hearty a greeting and such an affectionate and almost boyish cordiality, that every feeling of embarrassment was at once dispelled; in a few minutes several other old school-fellows crowded around him, giving him a most cordial and friendly welcome. One reminded him of a tremenduous threshing he had given him at boxing, another how he had thrown him in wrestling, another how he had beaten him in a footrace, and every one seemed to have some cherished recollection of their early friendship deeply engraven on his heart. By the time they were seated at the dinner table, all his nervous apprehensions had vanished, and he felt as much at ease as if he had been seated at the dinner table of the

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City Hotel, among his fellow citizens of New York. I have been told from another source that his speech, in reply to a toast in honor of his country, given at that dinner, was one of the most brilliant that he ever uttered. I mention this anecdote as an illustration of his career at Harrow; had he not established a high reputation there when a boy he would not have received so cordial a recognition when he returned in his manhood.

His father died in the spring of 1807, when Governor King, desiring to perpetuate the old homestead, purchased the shares of it owned by his brothers, and settled on it himself. It was, as I have before stated, situated in Jamaica, Long Island, and consisted of sixty acres. He simultaneously sold the farm which he had previously occupied.

Here he continued to reside until his death. For forty years he cultivated the land, but having more ample means at his command, he did not devote himself exclusively to the manual part of the work, as he had done in his earlier life. Still, he superintended the labor and directed the mode of tillage. During the harvest he was always in the field assisting in the haying and storing away of crops. The farm being small, it was necessary to work it thoroughly in order to make it productive, and, of course, it could not support much stock. Such as he had, however, were always of a fine quality. His father's herd of Devons were among the first imported, and came into his possession with the farm. These were in after years, fattened and sold, and were replaced by Durhams, which in their turn were succeeded by Alderneys. Among his most recent actions was the purchase of a fine young Alderney bull, the strain of his small herd having, in his judgment, been too closely bred.

On the opening of the Erie Canal and the other vast improvements which have been made for developing the resources of the great West, it became necessary for the farmers of Long Island to change their system of tillage. Governor King, in concert with his neighbors, adopted a new system of husbandry, having for its object the supply of the daily wants of the neighboring metropolis of fruits and vegetables, and he, with them, reaped much benefit from the change.

After traveling to the West a few days ago he, returned full of admiration of the great resources of that section, and almost longed to be the cultivator of a great western farm.

From the time of his return from England he entered again into

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the political arena from a sense of duty, and in the stormy period of 1829, when the great contest between Adams and Jackson was raging with its utmost fury, he received a nomination from the Adams party as member of Congress. A very large majority of his district being warm adherents of General Jackson, he was, of course, defeated; and finding himself shut out from any opportunity of serving the public in the political field, he turned his attention to works of internal improvement in his own town, county, and State. He was president of the first railroad that was made on Long Island, of several turnpike companies and plank roads leading from Jamaica to the city and to neighboring villages.

He did this because he believed they all conduced to the prosperity of the farming community by placing the crops speedily, with lighter draught and with less expense, in the markets.

In 1839 Governor King was a member of the National Convention which nominated General Harrison to the Presidency. He was a warm friend of Henry Clay and was exceedingly anxious that he should be nominated as President; but after a very full consultation of the members who represented every Congressional district in the United States, he became satisfied that his favorite would be defeated if nominated, and therefore, under a deep conviction that the success of the Whig party was of vital importance, he reluctantly voted for General Harrison.

In 1848, he was elected a member of the Thirty-first Congress. Scarcely had he taken his seat in that body than he began to give evidence of his strong anti-slavery principles. His speeches were frequent, abounding in facts and illustrations, and were full of eloquence and power. The Fugitive Slave bill was passed during the term for which he was elected, and it is almost needless to say that he opposed it with all his might.

He was a member of the National Convention that assembled in Baltimore in 1852, that nominated Gen. Scott for the Presidency. In the consultation respecting the platform, Gov. King always advocated taking the highest ground. He steadily opposed all compromises, and preferred defeat with an outspoken expression of sound principles, to a success which was purchased by their evasion or suppression.

The fusion of the Republican and Whig parties was effected at Syracuse in 1855, Gov. King being president of the Whig convention, and Gov. Fenton of the Republican convention. His whole

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soul was in this movement, and no man in the State labored more earnestly to effect it.

He was one of the delegates to the National Convention, which assembled at Philadelphia in 1856, and which nominated Gen. Fremont for the Presidency. Gov. King and Chief-Justice Hornblower having been appointed to conduct Gen. Lane, of Indiana, to the chair, the grace and dignity with which this duty was performed elicited the admiration of the vast throng of observers. He was himself one of the vice-presidents of the convention, and in the conference of the New York delegation he was like a flame of fire. He made several brilliant speeches at these conferences, which had the happiest effect on the members. He was the favorite candidate of the New York delegation for the Vice Presidency, but when it was made to appear that the name of Mr. Dayton would add strength to the ticket in New Jersey, he promptly insisted that his name should be dropped, and that Mr. Dayton should be the nominee of the New York delegation. His noble and unselfish bearing on the occasion smoothed the way for his own nomination for Governor of New York, in the ensuing year.

In 1857, he took his seat in the Gubernatorial chair of New York, the duties of which he discharged with rare firmness, wisdom and sagacity. In his message of that year, he pleads urgently the cause of popular education and of internal improvement. Towards the close of his message, in speaking of the preceding election, he uses these characteristic words: "The great principle at issue in the (last) election, and which it so triumphantly vindicates, lies at the root of our free institutions, and is alike the concern, and should be equally the share of all citizens who rightly estimate these institutions. No mere party questions could call forth so deep an interest and so insignificant and decisive a vote throughout the length and breadth of the State; and I venture to believe that I do not mistake its importance, nor your conviction respecting it, when I assume as its deliberate and irreversible decree, that so far as the State of New York is concerned, that there shall be henceforth no extension of slavery in the Territories of the United States.

"This conclusion I most unreservedly adopt, and am prepared to abide by it *at all times, under all circumstances, and in every emergency.*"

Governor King was a member of the Chicago Convention which nominated Abraham Lincoln for the Presidency, and was also a member of the Peace Congress, which met at Washington in 1860.

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He was one of the original members of this Society, and also of the United States Agricultural Society, of which he was for many years one of the Vice-Presidents. His interest in this Society was constant and unflagging, from its first beginning to the end of his life, serving in all its offices and taking his full share of all the labors incident to them. He was its President in 1849, and during his Presidency Prof. Johnson, of Edinburgh, delivered the valuable course of lectures before the Society, which may be found in our Transactions for that year.

Governor King was a most valuable coadjutor in all the affairs of this Society. Other men have been willing to labor in our ranks in places where honor and reputation follow in the wake of the effort, but no one has ever surpassed him in his willingness to work in the more unnoticed departments of our operations. He would assist in driving nails on which to hang pictures, stockings or quilts. He was ready to serve on committees, to bring lumber for sheds, or procure sprinkling carts to lay the dust on the ground; any and everything that was needed he was ready to do, and what he undertook to do, he did with all his might, and in the best manner that he was capable of.

Sometimes at the close of a fair, some old woman who had contributed a pair of yarn stockings to the exhibition, on which she was bent on getting a premium, but had been unsuccessful in bringing to the notice of the judges, she would come in great tribulation to the office wringing her hands and calling in the extremity of her anguish upon gods and men, for redress for her calamities.

It was beautiful to see how gloriously his face would light up on these occasions; he was very apt to remember that he was himself on that identical committee, and he would bewail his shortcomings in relation to those same stockings with an unction of remorse that would go right to the old woman's heart, and induce her to contrive all sorts of palliations for the offence; instead of needing to be comforted, she would feel it necessary to occupy the place of the comforter herself; and when it got to the point, he was not hard to pacify.

Then he would notice some evidence of youthful agility about her, something which would bear praise and congratulation, which he would offer with such heartiness of manner and such felicity of phrase, that her heart would be fairly taken captive. Arrived at the hall, the Governor would take the stockings lovingly in his hands and express admiration of some one quality; his admiration

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was always cumulative. First he would be delighted with the softness of the wool, then he would be forcibly struck with the evenness of the yarn, then the elasticity of the stitch would dawn upon his mind, next he would discover the exquisite symmetry of their shape, and finally his admiration would culminate in a most inordinate desire to possess the stockings himself, which he would purchase at more than twice their value and send the good woman away full of rejoicing and happy as a Queen.

For several of the last years of his life he was a member of our standing committee on wines, He was in his greatest glory on the wine committee, of which he was a member for many years. Seated with his associates in solemn conclave, the taste, the odor, the color, and "the moving itself aright" were observed with a conscientiousness and a patience which was never equalled in any other committee of the society. He protested against all haste in deciding. His patience in repeating experiments on the better varieties was inexhaustible, and he was resolved that no effort on his part should be wanting to arrive at a sound, impartial decision. It is believed that he was always successful, and that in no case was a bad drink palmed off upon the public under the sanction of this Society.

He attended the June meeting of the Queens county agricultural society in 1867, when he seemed to be in perfect health, and his step was as firm and elastic as ever. He was a successful exhibitor of fruits, flowers and vegetables at that first attempt of that society to hold a spring or summer meeting, and was highly gratified at the complete success of the exhibition.

His mind had latterly been much tried with family bereavements, and he remarked a short time before his death that he trusted that when "his summons came he might not linger, but be in his full activity and usual course of life, with his harness on."

The Young Men's Literary Union of Jamaica intended to celebrate the Fourth of July, and requested him to be present and participate in the exercises. He had for some time been averse to public speaking and sent an excuse, but whilst watching the operation of his mowing machine among the tangled clover he was urged by a delegation of young men, who would take no denial, to revoke his refusal of their request. He accordingly went with them and addressed them as follows:

"My young friends," he said, "I rejoice to meet you on this day. I rejoice to see your young hearts kindling with the hour. I rejoice to see with what enthusiastic fervor your have hailed the

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star-spangled banner, which, on this day ninety-one years ago, first shone on our eyes. Never forget that upon you will devolve the important duty of maintaining and strengthening the government of your country. Your country expects it of you. God requires it. Those who, like me, have nearly finished their work now look to you to carry forward your country in the great future that awaits her. Cultivate always a respect for religion and virtue. No people can prosper or become great without this. Let your aim be ever the service of your country and your God. Be ever ready to pledge your lives, your fortunes, and your sacred honor at her call, and let your prayers be not only that those who hold the positions of power may be wise and able and discreet men, but men fearing God, and whose only ambition will be to labor for the honor and glory of the land." He was then observed to falter and to lean against the table. He was smitten with paralysis, which involved the left side of his body, and was removed to his son's house, where every care was of course bestowed upon him, but it was all in vain. Although his mind was perfect until Saturday, the 6th, he was never conscious of his paralysis. He preferred to be left quiet, though his children, with one exception, were all in his room. He quietly and peacefully departed on Sunday, the 7th of July, 1867.

We have now, Mr. President, followed our departed ex-president in his useful and honorable career from his cradle to his grave.

It remains for us to inquire what is the especial message which he has left for us? What lessons for the regulation of our lives can we learn from the story of his career, which has engaged our attention this evening?

"Being dead, he yet speaketh," and while we listen reverently to his voice sounding out of the silence and solemnity of the tomb, let us heed well his precepts, and follow so far as strength is afforded to us his shining example.

First. We may imitate the beautiful consistency of character which manifested itself through his entire life. "His trumpet never gave an uncertain sound;" he never was found among the ranks of the waverers or the doubters, but wherever

> "The outworn rite, the old abuse,
> The pious fraud transparent grown"

was to be the object of an attack, wherever a blow was to be given for liberty and right against wrong and oppression, there Gov. King was to be found with his lance in rest, with his visor up, and with his armour on.

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Second. His integrity was unsurpassed. We have seen many enlightened and able men in the Gubernatorial chair of New York, but none of its occupants have surpassed him in the self-abnegation with which he administered the functions of his office. Certain appointments in the city of New York were urged upon him by very influential parties. "These men are thoroughly corrupt," said the Governor. "True," replied the parties who were urging them, "but they have great power, and they can bring many votes to our party." "I will give them money, but I *will not* give them office," was the Governor's sturdy reply. "If you nominate these men, we will insure your triumphant re-nomination." "Then I will relinquish a re-nomination, for I *will not* appoint them."

Such language among politicians is as rare as it is praiseworthy, and will embalm his memory with the sweetest fragrance wherever truth is loved or honesty respected.

Third. His reverence for manhood, as such, was a beautiful trait in his character. He was born and nurtured amid refined and aristocratic society, and he naturally enjoyed the company of those whose inherited refinement, and whose thorough culture fitted them to adorn and beautify social intercourse. But notwithstanding this, no man was more kind and accessible to the poor than he was. He always recognized in practice as well as in theory that whatever gifts of fortune, or education, or position were bestowed upon him by Providence, were not given for his own ease or enjoyment, but as a steward who was to dispense them to others. He was as a husband to the widow, and a father to the fatherless; he was an ever-ready instructor of the ignorant, a consoler of the afflicted, and a generous helper of the poor and the afflicted. A plain and lowly neighbor of his, as he followed him mournfully to the grave, said, in plaintive tones: "The Governor was a father to me. He was always ready to aid me by his counsel and encouragement, and I can never cease to recollect my obligations to him."

Fourth. His habitual suavity was a distinguishing feature of his character. Other men may have been as good and as kind as he; but there have been few, especially in high public station, whose goodness and kindness were manifested to the world with such a charming investure of manner. The greetings were so kind and cordial that they did good like a medicine, his conversation was so easy and unaffected, his words were so full of hope and charity, his hospitality was so free and genial that none who have ever partaken of it can ever forget it.

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Gov. King's good heart gave him a wonderful control over the rough and rowdy population of his village. Other men's fruit trees might be stripped of their treasures—his never were.

When it was ripening he would call them into his garden, telling them that he was once a boy himself, and that he knew by experience that boys loved fruit. "Now," he would say, "here is a tree and there is one, and there is one; as soon as they are ripe you shall be welcome to them, but, 'honor bright,' all the rest are for my use and I hope you will respect them." They always did. Not a cherry on those trees were ever missed. Such things did him a great deal of good. The happiness which they gave him could not be bought for money.

He had a wondrous power over his grandchildren. Children are wonderful judges of character and know right well whom they can trust. All their little secrets which they would not entrust to their own parents, were freely confided to him with the fullest assurance that he would keep them with fidelity and sympathize with them in their afflictions and rejoice in their joys.

He drew all hearts towards him.

> "None knew him but to love him,
> Nor named him but to praise."

Fifth. He was especially endeared to the Society by his skill and energy as a farmer, and by his hearty and unfeigned love of his agricultural brethren.

He was rarely absent from our meetings; he attended all our great implement trials, and aided and encouraged them to the utmost of his power.

He was one of the pioneers in the cause of agricultural education. In his messages to the Legislature, while Governor, he cordially recommended the College at Ovid to its liberality. He was one of its trustees, and labored with untiring energy to bring it into successful operation.

But, Mr. President, it is time to bring this eulogium to a close. It were useless to describe to an audience by whom he was well known, the manly beauty of his form and aspect, or the manifold attractiveness of his social qualities.

He will never be forgotten by us, but will always be enshrined among our chiefest jewels, and while we cannot do otherwise than mourn his loss, not only to our society but to the world at large, we still will evermore thank God that he has given to us so bright an example, and strive to follow him in the piety he manifested to God and in the love he bore to his fellow men.

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RINDERPEST.

FIRST AND SECOND REPORTS

OF THE

COMMITTEE OF THE N. Y. STATE AGRICULTURAL SOCIETY.

New York State Agricultural Society,
Annual Meeting, *February* 15*th*, 1866.

Mr. Judd, as chairman of the special committee appointed on the subject of the Rinderpest, presented the following resolution, which was unanimously adopted:

Resolved, That the Executive Committee of the New York State Agricultural Society are requested to give special attention to the progress of the Rinderpest in foreign countries, and to the danger of its introduction here. That they be empowered to use such measures as they may deem expedient for obtaining and publishing information in regard to the ravages and character of the disease, preventives and remedies to be used, etc., and that if, in their judgment, it at any time appears necessary or desirable, they are authorized to employ one or more competent persons to make investigations and procure reliable information either at home or abroad.

Executive Board, *February* 15*th*, 1866.

Mr. Conger moved the following resolution, prefacing its presentation with the expression of his desire that the President of the Society might be named as chairman:

Resolved, That the subject of the Rinderpest be referred to a committee of five to prepare from foreign papers and other sources a general outline of the statistics and pathological character of the disease, with such suggestions as to remedial or preventive methods as may be deemed advisable for the farmers of the State to pursue in the treatment of the disease, in the event of its appearance in this country during the ensuing year.

The resolution was adopted, and the President, Mr. Gould, Hon. A. B. Conger, Dr. Julien T. Williams, L. H. Tucker and M. C. Weld were appointed the committee.

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FIRST REPORT.

NEW YORK STATE AGRICULTURAL SOCIETY,
EXECUTIVE BOARD, *March 29th*, 1866.

The committee of the Society appointed to investigate the statistics and pathology of the Rinderpest, and to suggest preventive and remedial methods for the protection of the State from its ravages, beg leave, by way of preliminary report, and in brief outline, to submit to the consideration of the Executive Board, those facts and conclusions which, in the judgment of the committee, justify the establishment by law of an efficient system of sanitary measures to prevent the introduction and dissémination of this terrific malady.

Your committee have had access to many foreign journals, agricultural and medical, which in every issue are filled with statements of the destructive career of this plague, and mostly, with humiliating admissions of general failure to arrest its spread or establish any efficient system of cure. Your committee have also been favored through the Secretary of the Society, with copies of the first and second reports of the commissioners, appointed by Royal Commission to investigate the origin and nature of the cattle plague; and the reports prepared on the pathological appearances and symptoms of the disease by Dr. Smart, of Edinburgh, which were with great kindness and dispatch forwarded to the Secretary by Prof. John Wilson, F. R. S. E., Professor of Agriculture in the University of Edinburgh.

It appears that as far back as October 21st, 1865, a period of rather more than four months after the introduction of this disease into Islington, 14,083 animals had been attacked; 6,711 had died; 5,119 slaughtered; only 707 had recovered, and 1,546 remained under treatment. Since that time the statistics of *enumerated* cases had disclosed the appalling figures of 9,120 attacked in one week, ending January 6th, 1866, and at a later period over 13,000 in one week; in all, *officially reported* up to January 27th last, 120,740. It is believed, however, that at least two hundred thousand animals infected with this plague had been destroyed. Although at the last accounts, the rate of mortality had decreased, still the highest proportion of recoveries was only twelve in each one hundred cases.

In Belgium, where a vigorous system of quarantine had been instituted, and immediate slaughter of animals suspected to be suffering with the premonitory symptoms secured; only three hundred and six cases occurred seventeen of which died, the rest being

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summarily disposed of by public authority. One case lately occured at Antwerp, being traced to a smuggled cow. The market was at once closed, and all egress of cattle prohibited until further orders. The plague was thus successfully checked and Belgium has been free from its ravages ever since.

The disease entered France by one animal bought at Malines, and was arrested by the sacrifice of forty-three head of cattle. In November last, at the Jardin d'Acclimation, it made its appearance in the case of two gazelles, brought from India, which had been for three days in London. It spread rapidly among other animals at the garden, but was suppressed by the destruction of thirty-five ruminants of different species.

In Prussia, which has a long line of frontier, and is therefore greatly exposed from surrounding territory, where the disease has made extensive havoc, it has been kept at bay by the most determined action and instantaneous use of the knife.

Aberdeenshire, in Seotland, a county containing 150,000 head of cattle, adopting at the start a policy different from that pursued in England, has been quite exempt. It maintained a strict quarantine, and authorized summary destruction of all animals infected, under a system of compensation to the owners. Out of a fund of £3,000, raised by private subscription, £1,400 remained unexpended. Other parts of Scotland, which have neglected the precautions adopted in Aberdeen, have been frightfully devastated. Ireland, under a like system, principally of quarantine, established also with reference to persons employed about diseased cattle, has been untouched with these calamities.

The disease appears, from these statistics, and by a general admission of all writers on the subject, to be not only of a fatal, but of a highly infectious and contagious character. It is not only propagated in animals of the bovine race from one to another, but also to all classes of ruminants. The contagion is also conveyed in the clothes and by the persons of those employed in taking care of, or even of inspecting the diseased subjects. No remedial agencies have as yet been discovered which would justify for one moment the abandonment or neglect of preventive measures. Public policy and private interest alike, demand that the pest should, if possible, be stamped out.

Your committee believe that the introduction of this disease into the State of New York, which contains over two millions of horned beasts and three millions of sheep, with no sanitary regulations

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established by law for its suppression, would result, if the ratio of mortality should be equal to that in England, in a loss to the people of this State of at least five millions of dollars.

Your committee, therefore, recommend that the society should present a memorial to the legislature, invoking in behalf of the great interests of the farmers of this State, summary and efficient action by which the disease may be prevented from coming within the borders of the State, and for its extirpation in any locality where it may, by possibility, be introduced; and to this end have prepared a draft of a bill* to be presented to the legislature for its approval.

AN ACT to prevent the introduction and spread of the disease known as the Rinderpest, and for the protection of the flocks and herds of sheep and cattle in this State, from destruction by this and other infectious diseases.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. It shall be the duty of the health officer of the port of New York, in addition to the duties now imposed on him by existing law, to examine and inquire whether any animals are brought in any vessels arriving at said port in violation of any regulation of law passed by the Congress of the United States prohibiting the importation of such animals.

§ 2. Whenever any animal is brought as a ship's cow, with no intention of landing the same or of violating any such law or regulation of Congress as aforesaid, the same shall be carefully examined and kept in quarantine for the space of at least twenty-one days, and if any symptoms of the infection or incubation of the disease commonly known as the rinderpest, or of any other infections or contagious disease, shall present themselves, it shall be the duty of said health officer immediately to cause the said animal or animals to be slaughtered, and their remains boxed with a sufficient quantity of quick lime, sulphate of iron or other disinfectant, and with sufficient weights placed in said box to prevent the same from floating, and to be cast in the waters of said port. It shall also be his duty to cleanse and disinfect by suitable agencies, the berth or section of the ship in which said animal or animals were lying or

*The bill prepared by the committee was, at the request of the society, introduced into the Senate on the 31st day of March, by the Hon. Ezra Cornell, ex-President of the society, and with slight amendments, became a law, being passed on the 20th of April, three-fifths being present; a copy of the *law, as passed,* being given in the text.

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slaughtered, and also to cause the clothing and persons of all taking care of the same or engaged in such slaughter and burial, to be cleansed and disinfected.

§ 3. William Kelly, of Dutchess county, Marsena R. Patrick, of Ontario county, and Lewis F. Allen, of Erie county, are hereby appointed as commissioners under this act, and with powers and duties as hereinafter enumerated.

§ 4. In the event of any such disease as the rinderpest or any infectious disease of cattle or sheep breaking out or being suspected to exist in any locality in this State, it shall be the duty of all persons owning or having any interest whatever in the said cattle, immediately to notify the said commissioners or any one of them of the existence of such disease; whereupon the said commissioners shall establish a sanitary cordon around such locality. And thereupon it shall be the duty of the said commissioners to appoint an assistant commissioner for such district, with all powers conferred by this act on the said commissioners or their agents or appointees, which said assistant commissioner shall immediately proceed to the place or places where such disease is reported to exist, and cause the said animal or animals to be separated from all connection or proximity with or to all other animals of the ruminant order, and take such other precautionary measures as shall be deemed necessary; and if, in his opinion, the said disease shall be incurable or threaten to spread, to cause the animals aforesaid immediately to be slaughtered, their remains to be deeply buried, and all places in which the said animals have been confined or kept, to be cleansed and disinfected by any of the agencies above mentioned; and also to cause the same to be carefully locked or barred so as to prevent all access to the same by any animals of a like kind for a period of at least one month. Any animal thus slaughtered shall be appraised under the supervision of said commissioners, and one half of the value of said animal shall be paid by the State to the owner thereof.

§ 5. It shall be the duty of the said assistant commissioner, immediately on his being notified of his appointment, or at any time thereafter, of the breaking out of the said disease in any place contiguous to the same and within the county in which he resides, to give public notice of the same, in at least one newspaper printed or published in the said county, and to cause notices to be posted up in at least five conspicuous places in said neighborhood; and it shall be his duty to enjoin, in said notice and otherwise, all

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persons concerned in the care or supervision of neat cattle or sheep, not to come within one hundred feet of the said locality without the special permission of the said assistant commissioner.

§ 6. It shall be the duty of the commissioners appointed under this act, whenever they are advised that any such disease has made its appearance within the limits of the State, to publish in the State paper and in at least one paper published in any county where such disease exists, a statement of the methods approved by the New York State Agricultural Society for the treatment of cattle affected therewith, for the isolation of the same, for the disinfection of the premises or buildings in which said cattle are found affected as aforesaid, and for the prevention of the spread of the same through any agencies of whatever kind.

§ 7. The commissioners aforesaid, and all such assistants as they may appoint, whenever in their judgment or discretion it shall appear in any case that the disease is not likely to yield to any remedial treatment, or whenever it shall seem that the cost or worth of any such remedial treatment shall be greater than the value of any animal or animals so affected, or whenever in any case such disease shall assume such form of malignity as shall threaten its spread by processes either contagious or infectious, or otherwise, are hereby empowered to cause the said animals to be slaughtered forthwith and buried, as above provided, and to do all such things as are mentioned in the fourth section of this act.

§ 8. The said commissioners or their assistants are hereby empowered to enter upon and take possession of all premises or parts thereof where cattle so affected as aforesaid are found, and to cause the said cattle to be confined in suitable inclosures or buildings for any time requisite in the judgment of the said commissioners or their assistants, and prior to the slaughter and burial of the said animals and the full and complete disinfecting and cleansing of such premises; and all persons, whether owners of or interested in such cattle, or otherwise, who shall resist, impede or hinder the said commissioners or their assistants in the execution of their duties under this act, shall be deemed guilty, and on conviction of the same, of a misdemeanor, and shall be punishable with fine not exceeding one thousand dollars, or imprisonment not exceeding the term of six months, or of both, in the discretion of the court before which they shall be adjudged guilty as aforesaid.

§ 9. The commissioners shall have power to establish all such quarantine or other regulations as they may deem necessary to

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prevent the spread of the disease or its transit in railroad cars, by vessels or by driving along the public highways; and it shall be proper for the Governor of the State, by public proclamation as aforesaid, to enjoin all persons concerned or engaged in the traffic or transit of cattle or sheep not to enter upon any places or take therefrom any such animal or to pass through any such locality, and within such distances from the same as in the said proclamation may be prescribed.

§ 10. The sum of one thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay to the said commissioners for their services while actually engaged in the duties enjoined upon them in this act, at the rate of five dollars per day to each, and such further sums as may amount to their actual expenditures in traveling to and from the places they may be called upon to inspect or visit, and in the printing or publishing of all regulations or notices mentioned in this act. And the further sum of fifteen thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the treasury not otherwise appropriated, to pay for animals slaughtered by the provisions of this act, and the Comptroller is hereby directed to pay for the same on the warrant of the said commissioners.

§ 11. The assistant commissioners are to receive for each and every day while actually enaged in duties provided by this act the sum of three dollars per day, and all actual expenses and disbursements paid or incurred in the discharge of their duties as aforesaid, which said sums shall be a charge upon the county for which he is appointed, and shall, when duly audited by the board of supervisors of the said county, be paid by the county treasurer.

§ 12. The slaughtering of animals for beef after having been exposed to the contagion, or supposed to have been so exposed, may be permitted by the commissioners or prohibited by them, as they may judge proper.

§ 13. This act shall take effect immediately, and shall continue in force for one year.

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SECOND REPORT

NEW YORK STATE AGRICULTURAL ROOMS,
ALBANY, *June 15th*, 1866.

The committee of the Executive Board, in presenting their report on the remaining portion of the subject of the Rinderpest as referred to them, desire to acknowledge access to various other publications and treatises, on this and kindred diseases, than those mentioned in their preliminary report. Of these they would especially notice the essay of Layard, on the distemper 1745–57; the report of Jessen (now Counsellor of State and Director and Professor of the Veterinary College of Charkow) to the Russian Government, on the results of inoculation as a method of cure and extirpation of the disease; the inquiry into the pathology and treatment of the cattle plague, by Alfred C. Pope, Esq., and the sequel to the report made to the Lord Lieutenant of Ireland.

Others are referred to in the body of the report. They ought not to overlook the elaborate treatise of John Gamgee, principal of the Albert Veterinary College, London, &c., although the greater portion of this report was prepared for the press before access to his work. It exhibits large research and is of the highest value, when detailing his own independent observations or the investigations of others of equal science and repute. In addition to the topics discussed by other writers, this volume contains the debates of the International Veterinary Congresses (held at Hamburg in 1863, and at Vienna in 1865), on quarantine, diseases of cattle requiring police regulation, &c. Appended are papers by Drs. Beale and Cobbold on the entozoa found in the muscles after death, &c. It will be seen that we have drawn upon this volume by copious notes; that in our discussion of the pathology, frequent reference has been made to Gamgee's observations and those of his co-adjutors; and that, under the head of treatment, one of his remarkable experiments has been employed, as we trust, after a method which may result in robbing this plague of some of its terrors.

Of the works referred to in the first report, that of Dr. Smart, of Edinburgh, with its splendid pathological illustrations, has been most invaluable to your committee in the delineation of symptoms and morbid anatomy. These illustrations, with many of those of Jessen and Gamgee, have been copied and re-arranged, and will,

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doubtless, in their re-print, confirm to the eye of the reader the marked structural lesions of this disease.

Careful examinations have also been made of the description of the pathological lesions in cholera by Perigoff, and of those of diseases generally by Lebert and others, in order, if possible, to attain some basis on which to rest the comparative pathology of the pest.

A masterly article by Egan, of Pesth, a practical agriculturist (œconom) of Hungary, who has had a large experience in the management of cattle and the treatment of this and other diseases which are rife in that region, is appended to the second report of the Royal Commissioners. It is to be regretted that only that part of the article, as prepared by him, touching the Rinderpest, was forwarded by Lord Bloomfield for the use of the English commission, as it is believed that Egan's discussion of the various forms of anthrax, and of the epizoötic known in Hungary as the blood plague, would have thrown additional light on some portion of the labors of your committee.

With the materials before them, your committee have encountered a vast mass of variant statements and conflicting opinions as to observed phenomena, whether referring to symptoms, diagnostic signs, preventive or remedial agencies. Your committee have desired that their labors might lessen this confusion, and have aimed, in their classification of the various symptoms, to present the disease in its leading characteristics. Pursuing such a course, and seeking aid from the most recent investigations made by modern science on the action of blood-poisons and fungoid germs, your committee hope that their labors* may be of essential service to the Society, and through it to the State commissioners, to whom, in the event of an outbreak of the pest in this State, such vast interests have been intrusted.

In behalf of the committee,

A. B. CONGER.

* Much care has been given in the revision of the processes of Mr. Tolle, the artist, to whose skill the lithographing in colors of the illustrations has been committed. The time occupied in the attempt to make them faithful copies of the originals, the happy freedom which this country has enjoyed from any outbreak of this fearful pest, the desire of allaying apprehensions too easily excited, and the necessity of reprinting a large portion of the text to conform with the size (8 vo.) of the plates stricken off at a large expense, will account, in some measure, for the delay in issuing to members of the Society, copies of this second report.

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RINDERPEST,

ITS HISTORY, PATHOLOGY AND TREATMENT.

Diseases of animals are either epizoötic or enzoötic. This classification corresponds to that of the maladies which affect the human race, epidemic and endemic.

The former of each class have been defined as *dependent upon* or *originating in* some particular condition (constitutio-æiers) of the atmosphere, and as *attacking a number* of individuals at the same time. Thus they differ from the latter of each class, which are described as of purely local origin, at least in the first instance, and as comparatively limited or isolated in their development.

Diseases, however, that are at first endemic or enzoötic, may break out at a time when their diffusion is favored by currents of the atmosphere; when its condition by lowering the tone increases the susceptibility of the patient; or when chemical or other changes affect its normal constitution, and so develop fresh food for the local malaria. Then, these diseases become epidemic or epizoötic.

Most of such diseases exhibit this further peculiarity of developing in their course a malignant virus or miasm (perchance infinitesimal germs, with all the subtle rancor and prolific power of a fungous growth), which spread through or float on the atmosphere, intensifying the original power of the "*materies morbi*," whether originally local or not, and thus these maladies are *infectious*. But frequently it happens that the poison may be propagated by touch or direct application to absorbent surfaces, by inoculation or the like, and thus the disease may be not only infectious, but *contagious* also.*

We do not present this distinction as disposed to cope with any of the vexed questions in the schools, but simply (as the sequel will

* The absence of any verb in the English language corresponding to the term contagion accounts for the use of the verb "infect," as indicative of the action of contagion as well as infection; hence these terms are frequently used as synonymous. Physiologists recognise the distinction aimed at in the text, though some using infection or contagion convertibly, attempt to make the necessary classification as *immediate* or *mediate*, *contactual* or *remote*. This may serve for such diseases, on the one hand, as syphillis, framboesia, lepra, itch and the like, or for diseases transmissible from the lower animals, as hydrophobia, and on the other hand, for influenza, malarious or other fevers, &c. But it does not serve as well as the distinction in the text for diseases whose poisonous principle is equally efficient, whether by immediate application to the skin, &c., or by absorption through the atmosphere; as, for example, small-pox, hospital gangrane, plague, &c., or of glanders, as an instance of transmissible disease.

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show the Rinderpest to be capable of propagation by both methods) to guard, in the case of this disease at least, against the erroneous impression that it must be communicable, if at all, in one way or the other, and cannot be by both. Before, however, demonstrating that the great variety of observed facts do not sustain any such delusive view, it is desirable to trace the pest from its earliest appearance to its present formidable development in Great Britain.

I. History.

The Rinderpest had its origin on the Asiatic part of the steppes of Russia, more, it is said, than one thousand years ago, and in the times of Charles the Great. These steppes (from the Russian word "step," signifying a desert or dry plain) are natural feeding grounds, not unlike the lands of Guienne in France, the heaths of Northern Germany, and in many respects like the prairies of the Great West. In these steppes are now roving from eight to ten millions of cattle, more than half being reserved for market as fat cattle. Though the greater part of these immense ranges is more or less arid, that portion of the Asiatic steppe between the rivers Volga and Don is marshy and generally accounted to be the local source of the infection. Be this as it may, no part of the steppes, or it is said of Southern Russia (and the same may be affirmed of the Hungarian steppes, stretching from Vienna eastward of Pesth) is wholly free at any time from this noxious distemper, although there are long periods when it is measurably kept in abeyance.

We may venture to doubt the reliability of the assertions made in regard to the antiquity of this pest in the steppes, because Professor Simonds admits in his testimony before the Royal Commission (1st Rep., p. 7) that no symptoms of the disease, as it is said to have shown itself in the mediæval period, are sufficiently described to identify it with the malady as now existent. When the records of its identity were first made, or where they are to be found, we are at a loss to divine. We have met with no elucidation of these topics, nor of the kindred enquiry, whether the present disease is, by a law of modification operating from age to age, presenting, during its present cycle, a new phase or a totally distinct manifestation. And yet it is clear that those who hold the theory of identity, if baffled in its maintenance by symptoms and morbid phenomena which show variance and disparity not only in degree but in kind, should be prepared to defend the theory of transition from one species of virulent brooding disease to another.

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But of this anon, when we come to the pathological investigation of the pest.

As to its origin or its native home we are in less doubt. Professor Renault, president of the veterinary school of Alfort, in his memoir to the French minister of agriculture, has, after a thorough investigation, established the fact that this steppe-murrain never broke out spontaneously (*i. e.*, as an enzoötic) in any country or locality but that of the Russian steppes, and, as we have before intimated, in the Asiatic part thereof.

He also asserts that its transmission to other parts of the civilized world has been directly by cattle contaminated with the poison when they left their native pastures; poison, as we may suppose, if not already brought in contact with the blood-corpuscles, at least lying esconced in hair or on hoof, furtively awaiting the fatal lick or smell that insures its absorption by the system. It is very easy to imagine how a virus of this sort might, on this theory, work out all the terrible ravages that have actually resulted, when we understand that these cattle are moved from their pastures in immense droves, sometimes numbering one hundred thousand, and how, as they migrate towards the southern and western portions of Russia, developing and leaving behind them poisonous excretions, they thus distribute the plague throughout Poland, Galicia and Hungary. Thence the passage to Western Europe is comparatively easy, unless the cordon has been tightly drawn or the pole-axe vigorously swung. Thanks to such methods established by decrees at Berlin during the present century, the disease has never (says Professor Gerlach, 1st Rep., p. 25), when it has broken out in Poland, and sometimes appeared in Posen, Silesia and East Prussia, advanced since 1815 as far west as Brandenburgh.

In 1841 it penetrated into Egypt by cattle bought by the Pacha from Annatolia and Karamania, resulting in the desolating loss to that country of 350,000 cattle. During the Crimean war, and by the infection brought by Russian cattle into the Crimea, it was there fully developed; the French losing at Samsoun 8,000 out of 17,500 beasts, and the English 4,000 out of 10,000, a loss ranging from forty to forty-five per cent. The mortality in some parts of Europe has risen to ninety-four per cent., and in some localities not a single animal was saved.*

* The number attacked in the Austrian dominions was 296,000, of which 152,000 died. In 1863 it again invaded Galicia (in which country Professor Simonds first saw the disease in 1857), Hungary and its dependencies, fourteen per cent. of all the cattle in those coun-

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As the present apprehension of the outbreak of this plague in this country has arisen from its recent spread in England and Scotland, we will now present an outline of its rise and propagation in those kingdoms.

It is generally known in this country that the farmers of Great Britain do not raise food enough for its population. But it may surprise many to learn that the annual value of produce imported to supply this deficiency is estimated, on very accurate data, at upwards of forty millions of pounds sterling. It is believed that the prominent items in this extraordinary expenditure consist of cattle, meat, butter, poultry, &c. Most of the beef class of imports come through Holland and Belgium. Prior to 1865 but one importation direct from Russia is known to have been made into any port of Great Britain, and this into that of London on 4th July, 1860. But indirectly large numbers of Hungarian and Galician cattle have been brought to English markets; more of late years, as the completion of two great lines of railroads, which traverse Central and Southern Germany, and connect Hamburg and Rotterdam with Vienna and Lemburg, furnish quick transit for these supplies. (See 1st Rep., p. 7.) The immunity which England has enjoyed, prior to 1865, in such importations, is traceable to the rigorous police measures established in Western Europe, and to the fact that the incubative stage of the rinderpest rarely extends beyond a week.

But it seems that two importers of cattle, Messrs. Honck and Baker were induced by the representations of a Mr. Burchell, who subsequently acted as their agent, and, in expectation of a profit of one hundred per cent., to make a contract with the Esthonian Agricultural Society for a large number of sheep and cattle; the latter to weigh at least one thousand pounds each, and to be delivered at Revel after the ice had broken up in the Baltic. As same of the beeves offered did not come up to the contract weight, forty-six were sent down from the neighborhood of St. Petersburg, from which the agent was to choose. These being on their arrival much bruised, having been transported in four-horse wagons, and deemed by him not fit for the London market, three experts or judges were appointed by the local magistrates to say how many were in a suitable condition to take; and thirteen were so

tries taking the infection, and the average mortality, as given in Schmidt's Jahrbuch for 1865, was as follows: Hungary, 65 per cent.; East Galicia, 77 per cent.; Croatia and Slavonia, 81.6 per cent.; Military Frontier, 83 per cent.; Moravia, 88 per cent.; Lower Austria, 92 per cent.; West Galicia, 94 per cent.; Burowina and Styria (in which but a comparatively small number were attacked), 100 per cent. (1st Rep., p. 11.)

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adjudged. These, with the Esthonian cattle which passed muster, made in all three hundred and twenty-two; but as one died in the yard before shipment, only three hundred and twenty-one sailed from Revel, on the 22d day of May, 1865, in the "Tonning." This steam veesel landed at Copenhagen to await orders, whether, in view of the then state of the markets, the owners desired her to proceed to London, Hull, or any other ports, and in obedience to instructions she put in for Hull; at which place she discharged, on the 28th day of May, three hundred and twenty cattle, seemingly sound, and one which had sickened on the passage.* One hundred and forty-six of this number were sold for immediate slaughter at three different market towns, from none of which has any disease been traced; twenty were picked out by Mr. Baker to go to Gosport for like use and with a like result. The remaining one hundred and fifty-five arrived at London on 29th and 30th day of May, were placed in Mr. Honck's lairs, and sold in the Metropolitan market on the first of June. On enquiries addressed by the Royal Commission to the purchasers of these animals, they were all sound beef when slaughtered, as far as appearances could lead such judges to determine the fact.

We turn for a moment to another lot of cattle which have been supposed to have had considerable agency in disseminating the contagion throughout England. Twenty-three head of fat cattle were sent from Schiedam, in Holland, by a Mr. Defries, to his son, a salesman in the Metropolitan market, which were sent into the market on the 22d, 26th and 29th days of June, twelve of them thrice, the remaining eleven only twice. The markets of June being unusually dull, more animals than was customary were left unsold at the close of markets, and sent back to the yards where they lodged, which generally have sheddings attached and are called *lairs*. This lot of twenty-three were placed in the lairs of a Mrs. Nichols at Islington, which adjoin the cattle yards used by many drovers bringing stock to the metropolitan markets. As the prices offered for this lot of Dutch cattle were not satisfactory, they were, on the 2d day of July, re-exported to Holland.

On the 27th day of June a cow belonging to Mrs. Nichols (who had at this date a herd of ninety-three, which with sixteen or

*Prof. Gamgee (in 1st Rep. 102), says that this one was kept by Mr. Burchell on *brandy and water* during the passage to Hull, recovered from the attack, and was sold for £11. As confirmatory of the opinion that these animals brought down from St. Petersburg had the seeds of the Rinderpest in them, he has ascertained that a butcher at Revel was obliged to kill thirteen of those that remained.

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seventeen more purchased subsequently, were all destroyed by Rinderpest), sickened and died, as was supposed by the owner from poison. Two cows which on the 19th of June* were purchased in the Metropolitan market by a Mr. Baldwin, of Hackney, died of the same disease, one on the 29th of June, and within twenty-four hours after she was observed to be ailing; and the other on the 5th day of July. These three cases were attended by Mr. Priestman, a veterinary surgeon, who with a son of Mrs. Nichols brought the stomach and intestines of a cow of the latter to Prof. Simonds at the college, on the 4th of July, for examination. The Professor was also requested to inspect the herd and the premises, which he did with great care; had another animal killed, and took its stomach and appendages and some water from a well recently opened, to the college for examination. On the 9th day of July he was fully satisfied that these animals and others reported at that date had died of the same disease which he had observed in Galicia in 1857.

Twenty-one of the Defries cattle died shortly after their arrival at Schiedam, it having been observed before their departure that they were out of health. Moreover the plague was communicated to the stock of a Mr. Vandervelden, grazing in a pasture adjoining† that in which the Defries cattle had been placed; and the owner of the stock contaminated in this wise had, in utter ignorance thereof, sold upwards of twenty, which were exported to Norfolk.

To return to Mr. Baldwin's stock. In twelve days after his first loss his herd of twenty animals was reduced to ten, his saving up to that time of fifty per cent. being attributable to the immediate slaughter of each animal on showing the first symptoms of the pest.

In a brief review of these statements (as it is impossible in this sketch, to give all the particulars which go to confirm the conclusion) the only animals which could have conveyed Rinderpest directly to English stock were brought into the Metropolitan market; from which those that developed the contagion earliest were sent to three places, two in England and one in Holland, where it was definitely recognized. And although an interval of nineteen

* Prof. Gamgee states that the running from the eyes and nose, and the drooping and other primary symptoms, were observed in the market as early as the 14th of June, and gives the history of two Dutch cows brought there on the 19th, which went to Lambeth Walk, and communicated the disease in that neighborhood, one of them sickening shortly after the purchase, (1st Rep., p. 103.)

† Prof. Gerlach states that this pasture was full one thousand paces from that in which the Defries cattle were placed.

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days has to be accounted for, there seems to be little difficulty in accepting the theory of Prof. Simonds (1st Report, 1–20), that the pestilence was in its state of incubation in one or more of the thirteen animals sent down from St. Petersburg to fill out the contract of the Esthonian Society; that it was developed in the lot brought to the Metropolitan market; thence spread to Mrs. Nichols' lairs at Islington, and to Mr. Baldwin's farm at Hackney, on or before the 20th of June, and through the Dutch cattle into Norfolk early in July. Even if the impression, as communicated by the English Consul General at Hamburg (1st Rep., p. 7), and based upon the opinion of Mr. Schrader, a veterinary in the special employ of the Hamburg government, be correct, that the Rinderpest was developed by Hungarian cattle sent from Vienna to Utrecht early in May; this would require proof of the transmission of some of these cattle, or of others infected by them, to the Metropolitan market in order to account for the earliest observed outbreaks of the plague which we have given. If true, this theory would only show a double source of infection concentrating at a common point and thence to be diffused. Suffice it to say, that in a very short space of time from its outbreak in Islington, the Rinderpest appeared in Suffolk and Shropshire. Before the end of July it had invaded Scotland,* and by the 14th of October it had extended into twenty-nine counties in England, two in Wales and sixteen in Scotland, and resulted in six months in a loss of two hundred thousand animals, and within nine months of three hundred thousand, at the lowest calculation; an enormous havoc, resulting mainly from a neglect to establish, as has been shown in the preliminary report, efficient sanitary cordons.

It is conceded that it is by no means an easy task to trace with exactitude the subtle course of a pestilence which thus dashed with rapid and fatal strides through the herds of Great Britain as it had previously held on in its mad career on the Continent. Nor less difficult does it seem to arrange and classify the various statements given as to the mediate instrumentalities of its spread. Too much concurrent testimony exists, however, of the poison being carried on the persons and clothes of attendants, diffused by excretions from the mucous surface, the skin and the bowels of diseased subjects; sometimes caught upon the wings of birds or clinging to

* Prof. Dick says that the infection in Edinburgh came from a herd of Dutch cattle brought down from London, two of which were bought by a cow-feeder named Ogg, and lodged in his byres; and that these developed the disease on the 8th of August, all the animals Ogg had dying except the *two foreign cattle*, which *recovered*. (1st Rep., p. 120.)

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their claws, so that falling plumes or alighting tracks might contaminate green pastures or farmsteads kept scrupulously clean—to cast a prudent doubt upon what would seem to partake only of the marvelous and fanciful. Proof may be deficient to show that in many cases the pest has been communicated, as some have affirmed, through the antennæ of flies crowding together on the glairy mucus exuding from eyes, nostrils or vagina; or conveyed on the hair or feet of horses, cattle or dogs beyond the limits of developed contagion; or by like secondary agencies, and to a locality sufficiently remote, for its spread by gradual or ordinary diffusion. Yet it is asserted on evidence seemingly beyond impeachment, to wit, on the statement of the Governor of Silesia to Professor Simonds (1st Rep., p. 3), that the outbreak in that province occurred in consequence of a carpenter's passing surreptitiously the frontier cordon from Galicia in order to visit his father, and incautiously mending a manger in the cow sheds, thus communicating the seeds of the disease, which in a few days broke out in what had been prior to that time a perfectly healthy district.*

Also, it is gravely stated in a communication on the nature of this disease, transmitted to Lord Bloomfield, and by him to the Home Government, that with a straw from an infected stable half a dozen healthy stables could be infected. All such statements may be grouped together as sufficient, if not incontestable, testimony of the ready communicability of this poison by contact, and other instrumentalities of contagion proper.

But when we learn that it is also conveyed by currents of the atmosphere, as in instances where, for a distance of three miles, it was carried by a strong prevailing wind (the air being charged with much moisture) from byres where the disease existed to perfectly healthy herds; or where from the same causes, it has overleaped all quarantine regulations, we have sufficient evidence of its dissemination by currents of the atmosphere, and thus being propagated in accordance with the laws of infection proper.†

* Gamgee was assured that a common cause of widespread outbreaks was the practice of calling priests and people together to pray in the cattle sheds that the plague might be stayed, and the assembled people moving thence from farm to farm. He also quotes the authority of Vicq d'Azyr, as to the infection of the eighteenth century, to show that where clothes of attendants on diseased cattle were placed on healthy ones three animals out of six would be seized with the disease. (Cattle Plague, p. 37.)

† Professor Brown gives in his testimony (1st Rep., p. 21) an account of the outbreak at Whitewell as from some beasts bought in the metropolitan market on the 1st of July, and its transference to Thimble Thorpe, a distance of three miles, as well as other places at least equally distant, where there "could not be traced any direct contagion and no

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We have adduced at this time these items of evidence as to the easy and rapid diffusion of the rinderpest, in order to supply as best we may any seeming defect in the testimony laid before the English commission to make out the historical proof of the dissemination throughout Great Britain of the germs of this murrain from the Esthonian importation. We may thus seem to trench too rapidly upon a discussion properly pathological, and to anticipate the handling of our second main division, to which we will at once proceed.

II. Pathology.

This branch of our subject we propose to consider under the ordinary classification of Descriptive (A) and General (B), designing further to subdivide the former by treating first of the *symptoms* (A 1,) or descriptive appearance of the disease as it is manifested in the infected animal before recovery or death, and next of the *morbid anatomy* (A 2), or description of the lesions revealed by *post mortem* dissections. In a few cases, taken from Jessen's Report (*Bericht - - - - Impfungen der Rinderpest*) on the results of the inoculative methods, we have for convenience given the symptoms and *post mortem* revelations conjointly. Further historical reference to other murrains, and the consideration of their destructive characteristics as compared with the Pest, will be reserved for the general discussion.

As we derive our knowledge of the symptoms and morbid anatomy of this distemper from authorities recognized as such in England and on the continent, of whom we may enumerate Smart, Wood, Simonds, A. & J. Gamgee, Simon, Pope, Gerlach, Egan and Jessen; where there are conflicting or independent statements, we will subjoin to such the name of each authority.

direct contact with diseased animals." He thinks it quite possible that the contagion could be carried by flies. He was also cognizant of the attack on the stock of Miss B. Coutts and Lord Granville, in *pastures quite private*. In the first case there were diseased animals three-quarters of a mile off, and the outbreak occurred a short time after a thunder storm, when the wind blew from the infected places. Yet sheep in an adjoining pasture had been several times in the market. In the latter case, where only seven out of one hundred and thirty remained, Mr. Panter, the bailiff, holding to the theory that the diseases of 1865 and 1745 were the same, and with some show of consistency, because he believed that the pest broke out spontaneously in the London cow shed during the hot weather of June, states that the nearest place where the plague existed prior to its discovery in the stables under his care was four hundred yards off. He states also that pleuro-pneumonia was chronic on the farm, "Lord Granville never having been a month without it in the last four years."

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(A 1) SYMPTOMS

These will be arranged after the following classification of the several stages or periods of the disease: 1st. *Incubation;* 2d. *External symptoms;* 3d. The *Congestive Period;* and 4th That of *Resolution.*

FIRST. INCUBATION.

From the time of the first introduction of the poison into the system, until the development of the external symptoms, a period elapses of several days, which is known as the *incubative stage* of the disease. The time assigned by different authorities varies considerably, though there is but little doubt that we may fix this period in the majority of cases as one of six days. This is the time assigned by Smart and Wood. Egan states it from four to eight days. (2d Rep., p. 79.)

The period of incubation varies according to the mode of the introduction of the poison; where the disease is inoculated, I believe it is four or five days; but where it is caught in the usual manner, from eight to ten days. (J. Simon.)

In the inoculation cases which I have had, it has usually averaged from six to eight days, and not beyond that. It cannot be longer than ten days, if ever so long. (J. Gamgee.)

It is seldom less than seven days, and it may be extended to fourteen or fifteen days, or perhaps to a longer period than that. (Simonds, 1st Rep. p. 16.)

The period of incubation is generally from five to seven days, though in rare cases it may be more. (Gerlach, from personal observation, 1st Rep., p. 20.)

The evidence as to the internal development of this disease in its primary stage, is drawn principally from post-mortem observations of animals slaughtered soon after exposure to the contagion, and attests the fearful rapidity with which it is absorbed. And first it is stated that within thirty-six or forty-eight hours after inoculation, the blood is so thoroughly contaminated that a single drop is sufficient to develop the disease in all its malignity when employed as an inoculative medium, though Gerlach states that blood is rarely if ever used, as the secretions of the eyes, nose and mouth are, in the remedial agency of inoculation. (1st Rep., p. 20.)

Invariably in the early stage, even before the vulva and mouth have become affected, the lining membrane of the fourth stomach, and of the whole intestinal canal from that stomach downwards,

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shows appearance of disease. This is indicated by what is at first a mere blush of redness on the surface of the lining membrane, quite appreciable, however, when compared with the pale, fawn-colored appearance found in the healthy state. (Wood.)

The other stomachs soon sympathize with the condition of the fourth; the rumen or paunch, and second stomach or reticulum, are loaded with undigested food, and the third or many-plies is impacted with a mass which assumes the form of a large round ball, and becomes, as the disease advances, a hard, dry mass.

SECOND. EXTERNAL SYMPTOMS.

As the incubative period declines, the primary symptoms visible to the eye occur in the following order:

a. Loss of appetite, exhibited first in aversion to all sorts of green food, and on the following day in indifference to food of any kind. At first the animal leaves a portion of its food, and then refuses it altogether.

b. Rumination. The animal now ceases to *chew its cud*, and then there is manifest

c. Constipation in its gradual development. The dung is of a dark color, sometimes covered with slime on its surface. [Many show signs of belly-ache, by frequently looking round towards the tail and bending up the back.] (Egan.)

d. Diminution of the flow of *milk* (much greater than in pleuro-pneumonia. Priestman.)

External appearances are, first,

1. *Depression* in looks, standing in the same posture, with drooping head and reclining ears. These, with the horns and other extremities, show a loss of natural heat.
2. The first striking signs are manifest in a change of manner. Most commonly the beast is remarkably heavy and dull, hangs its head, lowers its ears, stays behind the herd, and when in the stable *keeps away from the crib.* (Egan.) Sometimes there is a shaking of the head to and fro. If you lift it up, *it goes down again like a dead weight.* (Ernes.)
3. Sometimes an animal will be *excited*, uneasy, shaking its head, stamping with its feet, lowing frequently, butting with its horns, and running away from the herd. If tied up in the stable, it tears away from its chain and rope, and continually endeavors to go elsewhere. (Egan.)
4. *Trembling motions* now occur of the head and neck; the

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hairs bristle up, especially on the back and towards the shoulders; the insertions of the horns and ears are sometimes cold, sometimes warm; the palate is dry; the eyes shining, &c. (Egan.). In the cases first observed in England by Professor Simonds, there were not the same nervous twitchings about them that had been observed in Galicia. (1st Rep., p. 9.)

f. Respiration is slightly quickened, the expression or *outbreath* is prolonged, and the pulse rises a few beats. (Smart.) Joined with a striking motion of the flanks and low groans, sometimes a short, dry cough supervenes, which is the cause of much uneasiness to the animal. (Egan.) In most cases a cough, with great difficulty in breathing, exists, the animal making more noise on expiration than in pleuro-pneumonia. (Gooch's account of symptoms of Dutch bullocks in Norfolk, communicated to Prof. Simonds, 1st Rep., p. 10.)

g. The *vulva* (the external opening of the vagina or passage leading to the womb) assumes a *reddish* tinge (with generally a few bluish streaks—Wood), and the color deepens as the disease advances, these appearances furnishing in females the *most reliable* and distinctive external characteristics of the disease. (Smart and Wood.)

h. The *mouth* shows a faint *red* or *purple* line on the under gum along the roots of the teeth, closing up the column of primary symptoms within forty-eight hours. (Smart.) The buccal membrane, particularly at the junction of the interior of the lips with the gums, becomes abraded or excoriated—the membrane peels off in little irregularly shaped spots, presenting a mouse-eaten or mouse-gnawed appearance. The papillæ of the tongue and cheeks are enlarged. (Per Barron, V. S., Sequel, &c., p. 26.)

In the vulva and mouth we have the distinctive sign of the Rinderpest; and in the latter the appearance can be readily distinguished from that observed in epizoötic eczema or mouth and foot disease.

THIRD. THE PERIOD OF CONGESTION.

This is the stage of the disease when the congestion, which has exhibited its earliest outbreak in the epithelial membranes covering the mucous surfaces of the fourth stomach and in part of the bowels, and then shown itself in the vulva and mouth, becomes active and pervades the entire system, showing in the first place a largely quickened action of the

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a. Pulse. The number of pulsations in health may be rated at forty to forty-five per minute in the field, and fifty to sixty in the byre. The pulse now *mounts up* to eighty, ninety and even one hundred beats per minute (Wood); sixty to one hundred and ten (Smart). Thirst and loss of appetite become more marked.

b. Respiration becomes *hurried*, and frequently labored and noisy, instead of from eighteen to twenty per minute, as in health the respirations range each minute from forty to sixty and considerably higher (Wood); thirty-six to seventy (Smart). The respirations numbered ninety-six in an animal which recovered, and are often *jerking* in their character. (Pope.)

c. Temperature of the body (externally) is *lowered*, and deficient, requiring the use of blanketing, and that the temperature of the byre should be raised to seventy degrees Fahrenheit. (Smart.)

d. Vital depression is characteristic of this disease throughout its entire progress, and becomes manifest as the congestion is extending over the internal organs.

e. Exudations from the eyes (viscid, slimy tears—Egan), nose, mouth and vulva, form with rapidity, consisting of a glairy, ropy mucus, and indicating the extended congestion of the external membranes of these organs; those of the mouth and vagina exhibiting *apthæ* The conjunctivæ are congested, becoming, as the disease progresses, perfectly turgid; large plugs of dense ropy mucus being occasionally passed. The alæ are more swollen and injected on their internal surface; externally copper-colored and livid looking patches are observable, about the fifth or sixth day, and in many instances a little earlier; the discharges become purulent alike from the canthi, the nostrils and the vagina. (Pope.)

An abundant yellow or bloody, stringy discharge comes from the nostrils, which gradually becomes white and fetid, and a tough viscid slime also flows from the corners of the mouth, and at the same time there are found on the mucous membrane of the mouth, especially between the under lip and gums, small blisters, which often cover the whole inside of the mouth; the sick beast grinds its teeth, which are now very loose. (Egan.)

f. The *anus* is frequently very highly *congested*, presenting the appearance of intense hemorrhoidal congestions.

g. The *urine* is now not unfrequently *loaded with blood*, and is passed with considerable pain and difficulty. (Pope.)

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FOURTH. THE PERIOD OF RESOLUTION.

The congestion is frequently favorably resolved by nursing and judicious treatment; by the strength of natural constitution, overcoming easily at the outset the diffusion of the virus, and affecting what commonly passes for a light attack of the disease; or, as frequently happens in a pregnant cow, by the concentration of the disease, in the fœtus and uterine membranes, and consequent abortion.

In all such cases the animal begins to look cheery, carries its ears forward, begins to take food and chew the cud. The milk returns and gradually assumes its natural appearance. The distinctive appearances on the vulva and the inside of the mouth disappear very slowly. (Wood.)

The attacks (of pain, &c.,) gradually subside, the skin becomes warm and remains so, appetite and rumination return, looseness diminishes, &c.

In convalescence, a scabby eruption very often appears on the skin, accompanied by itching, especially on the nape of the neck or the sides of the neck, and on the back. (Egan.) This scabby eruption, sometimes also seen on the nostrils, and frequently met in other parts of the country, has *not* been seen in more than a dozen cases that have been *treated homœopathically* in this neighborhood. (Pope.)

If, however, from the virulence of the attack, or the lack of sufficient constitutional power to resist the disease, or from neglect and injudicious treatment, the period of congestion is not relieved by any favorable indications, then follow the symptoms which result in death.

Sometimes in the natural course of the disease, more frequently perhaps from the injudicious use of irritant purgatives, the constipated state of the bowels is changed to a diarrhœic condition. The dung becomes soft and pappy, and at length liquid, not unfrequently colored with blood; it is usually voided with little effort in small and frequent passages. (Egan.) "Diarrhœa, often dysenteric in its character, or thin, watery and offensive in the highest degree, sets in, and exhaustion, accompanied by intense restlessness, follows, and death takes place from simple exhaustion. Sometimes where symptoms seems to have improved, the animal becomes suddenly more dull; the head drops, the eyes look heavier, the conjuctivæ are almost livid, the teeth are ground, the animal butts

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at everything within reach, oftentimes becoming furious, and suddenly dies." (Pope.)

Again; diarrhœa might set in on the second or third day, and about the fifth day it is generally fatal; but it begins by nervous symptoms, and these are so strong at times that a cow might be found dead in the morning without having been suspected to be ill at all. (Simonds.)

On the other hand, constipation is attended not unfrequently with great distention of the abdomen, becomes obstinate and aggravates all the other symptoms. Respiration is now slow, very laborious, moaning or grunting, and the pulse slow and small. The superficial membrane of the mouth peels off from the gums and lips, leaving the surface raw. A similar action occasionally takes place in the intestinal canal, resulting in a desquamation of its mucous surface in casts. In one case the entire epithelial lining of the small intestine, in a perfect tube, was passed from the bowel and has been preserved. (Smart.) The general weakness and leanness (of the body) makes rapid progress, the eyes sink in, the sight is weak, air tumors rise in the back under the skin, groans and difficulty of breath become continually more violent, the ichorous discharge from the open fundament flows involuntarily, and finally the beast cannot stand any longer, but lies on its sides with its head turned, until at once, generally, between the fifth and ninth day (in very bad cases between the third and fourth) death comes on with convulsions. (Egan.)

The staring hide and arched back are not characteristic of the Rinderpest, but of pleuro-pneumonia; but they occasionally make their appearance when the *pest* is *complicated* with the latter disease. (Smart.)

On looking at the carcass the hair is seen bristling; a whitish slime appears at the corners of the eyes and nostrels, partly dried to a bark; the hind quarters are much swollen; the mucous membrane of the bowels, projecting through the fundament, is of a bluish red color, &c. (Egan.)

We deem it judicious to add to the already extended account of general symptoms, a few detailed cases taken from Jessen, of animals described numerically in his report; because the accuracy of his details (as to time at least) may be of future benefit in the study of individual cases should the disease break out in this country. We have also added to the description of symptoms in each case, the *post mortem* observations, that the symptoms and patho-

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logical appearances might be grouped together, and for the further reason that it may be desirable to separate the description of his inoculated cases from those given by Smart and others, and perchance distinguish between the English type of this murrain and that observed in some parts of the continent.

No. 6 was a steppe cow, seven years old, *sickly before vaccination* and in thin flesh. Woolen threads were saturated with the secretions (from eyes, &c.) of a yearling calf, and inserted as a seton on both sides of the neck and before the shoulders.

Symptoms as follows: On sixth day, short hacking cough. On seventh day, loss of vivacity, drooping head and hanging ears; rumination ceased; shaking of head; gnashing of teeth; hair bristling and skin lying in folds. On the right side auscultation showed blowing murmurs; and percussion, dullness. On same evening, eyes and nose began to run; milk diminished and had strong salty taste; respiration and pulsation equal to sixty per minute. On eighth day these rose to eighty; secretions increased; ears and horns alternately hot and cold; mouth hot; chilliness over the whole body; neither eat nor drank. On ninth day, respiration one hundred with sighing; left side of bowels tympanitic, but normal at six P. M., when pulse was eighty eight; diarrhœa mixed with blood; aphthous appearance of vulva. On tenth day, pulse one hundred and eight; respiration fifty, and sighing; bloody diarrhœa; colliquations from nose and eyes; body cold, and death at six P. M.

Post-mortem. Besides ordinary external appearances, the veins of the brain were engorged; one of the lymphatics contained hard particles; hyperæmia in the base. Lungs full of air, not much reddened (emphysema in all the cellular tissues between the lobes) and contained many hydatids. Pericardium and heart normal. *Mucous membrane of fourth stomach* (Pl. IV, fig 2), violet in some places; in the folds ecchymoses shining through; duodenum not much reddened, and filled with bilious slime. *Jejunum* (Pl. VII, fig. 1) colored blackish by pigment on the mucous membrane. Here, and in the ileum the peyerian glands raised and strongly injected. The *capillaries* of the *colon and cæcum* (Pl. VIII. fig 1, giving a view of the mucous membrane of the latter), were injected, showing a great many red points and streaks, which were also found in the rectum, but *nowhere ulceration;* many ecchymoses in the small bowels, visible inside and outside; mesenteric glands swollen and showing much pigment when cut through. In every one as *a proof of former ailment, chalky concretions* from the size of a *lentil to a*

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pea. Liver full of hydatids; ovaries, kidneys and bladder normal and their mucous membranes healthy.

No. 14, a steppe calf of No. 6, nine months old, and placed beside his vaccinated mother, caught the infection naturally, and after twenty-seven days from first exposure seemed to have recovered, and was sent to a neighboring place to be herded with another lot of diseased animals. After twelve days it was started for home, and being led behind the wagon with a rope tied carelessly around its neck, it suffocated and was brought home dead.

Post-mortem. Lungs partly hepatized with some small ulcers; ventricles and auricles of the heart empty; paunch distended; third stomach hard, and when opened epithelial lining adhered to the food; *fourth stomach* not reddened, but close to the *pylorus* there appeared a covered *depression* (with a light scab, which was loose at its periphery) with smooth rounded edges, *apparently an ulcer* (Pl. II, fig 2) *beginning to heal;* small bowels contained slime and bile; some intestinal glands showed hard *elevations* of the *size of a pea* having a *hollow on the top;* intestinal veins and those of the brain engorged; liver, kidneys, bladder and brain sound. The immediate cause of death was vascular apoplexy from strangulation. The calf, though *apparently* recovered from the pest, had not *overcome its sequelæ.*

No. 8 was a two-year-old steppe ox, healthy and in fine condition, vaccinated on left shoulder with three woolen threads saturated with fluid from tears of a rinderpest subject.

Symptoms as follows: On sixth day, loss of appetite; rumination suspended; ears and lips hot, the latter dry; P. M., loss of strength, with downcast looks. On seventh day, lying down, with head stuck out and tears in the eyes; hair bristling; pulse, eighty-eight; respiration, thirty-six; inspiration slow; expiration quick; dung softer; great loss of strength during night; at noon, gnashing of teeth and diarrhœa; pulse ninety-two; respiration, forty; at evening, shaking of head; deep sighing inspirations, with pawing of the fore feet. On eighth day, does not eat; pulse, ninety-two and small; respiration, forty; tears flowing profusely; secretions from nose increased; gnashing of teeth and shaking of head more frequent; watery diarrhœa; increased debility and great thirst; pulse thinner; secretions stringy and thick; not so much head shaking; diarrhœa frequent, with no fœces and sour smell; mouth hot and covered with tough mucus. On ninth day, pulse ninety-eight, small; stroke of the heart hardly perceptible; all symptoms exacer-

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bated; mucous membrane of lips and anus full of erosions, on the first white, on the latter red, of varying size and form; in the evening, pulse small and hardly to be felt; respiration, forty-six, with heaving in the flanks; peculiar look of the dim eye; frequent and severe shaking of the head; great thirst. On tenth day, pulse eighty-four and fuller; respiration more quiet and thirty-six; animal more lively and strives to eat; erosions around the anus spread to the scrotum; at noon, diarrhœa increased, animal hardly able to stand; pulse small and vacillating; respiration forty-four; he wants to eat, but cannot chew; in evening, great moaning, and gnashing of teeth more frequent. On eleventh day, he is more lively; eye more lustrous; pulse more full, eighty-four; respiration, thirty-six; desire for food and drink; death in the evening.

Post-mortem; made before the body was quite cold. Great emaciation; muscles of natural color; fat normal and soft; first and second stomachs and œsophagus filled with greenish colored fluid; cardium greatly distended; when cut, contents were observed to fill the entire cavity of the chest. In nostrils was seen a free-lying exudation, having several small branches as if from the bronchiæ. Cellular tissue of pericardium and mediastinum, and between the lobes of lungs distended with air. Lungs bright red, parenchyma normal; pericardium and heart healthy. In right ventricle very fluid red blood. Brain very soft; great deal of blood under the dura mater; no water in ventricles or spinal cavity; bowels pale externally; liver of normal color, very sanguineous; gall bladder full of dark green gall; spleen full of blood and soft. First and second stomachs contained little food but much water; membranes normal. Third stomach contained partly old, partly newly taken food (bran), perfectly normal. Fourth stomach full of soft food; membrane loosened, in parts injected, especially near the pylorus. The small bowels throughout showed in many places *firm, elastic, fibrinous masses, yellow in color, products of the Peyerian glands.* (Pl. VI, figs. 1 and 2, giving sections of the *duodenum*, with *one Peyer's gland* and *two follicles* in fig. 2.) The fibrinous masses were also on solitary glands of the thickness of a line or more; mucous membrane loosened and easily separated from the muscular coat. In cæcum, colon and rectum, no fibrinous masses. Mesenteric glands pale, enlarged and hard.

No. 32, a steppe calf of nine months old, which after inoculation was severely sick and died suddenly; symptoms not given.

Post-mortem. Mouth free from erosions; nostrils somewhat

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reddened; chest showed a few emphysematous spots; heart full of coagula (clots); endocardium normal; liver rather soft, containing some fibrinous masses; gall bladder full; spleen full of blood; kidneys normal; first and second stomachs full of soft food, but normal; third stomach of the form of a ball; food dry and dark green; epithelium not adherent; mucous coat of fourth stomach strongly injected, especially towards the pylorus, and contains thin, bilious slime, but no food; mucous coat softened; small bowels full of enormous fibrinous concretions. On Peyerian glands, *thirty large plaques* were counted, from pylorus to cæcum, covered with *exudations* of three to four lines wide, *sticking fast to the glands*, even after sixteen hours' maceration. Taken off, the place corresponding to the glands was dark red. The whole formed a mass, flattened on both sides, of yellow or red color, with alternating elevations and depressions, and corresponding to the length of the agglomeration of the glands. Usually there was a *large tail* of three to four inches of light *yellow exudation*, showing in many places depressions, originating in the *solitary follicles* of the *jejunum*, which were reddened and hyperæmical (Pl. VII, fig. 2). In the small bowels were many free *exudations* like polypus (Pl. VIII, figs. 2 and 3), *all with these depressions*. Before the bauhinian valve of the cæcum were pulpy, macerated glands, of one and a half inches in length. Large bowels contained thin fluid, light yellow and grey slime. Their coats were softened, with red spots (injected vessels), especially where the rectum begins. Mesenteric glands enlarged—externally grey, internally dark grey—containing much fluid and yellow fatty exudations. Membranes of the brain and cerebellum strongly injected and softened.

(A 2.) MORBID ANATOMY.

On the dissection of the carcass, which is considerably distended with gases, a foul smell is experienced, which has a *peculiar* odor, and which is more intensely *disgusting* as the autopsy is extended into the abdominal cavity. It is highly *characteristic*, because if once experienced it cannot be mistaken for the exhalations consequent upon the examination of animals dying from any other disease. The pathological appearances which follow are principally those obtained by Dr. Smart from dissections made at the Edinburgh Sanatorium and at Tyne Castle, of over one hundred animals. Wherever other authorities differ from Smart, we shall, under each head, note the discrepant statements, as these clearly reveal modifi-

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cations of the disease as observed by Smart, depending upon differences of nervous susceptibility of constitution, perhaps of climatic influences; different habits in regard to food, diet, previous or concurrent lesions of other diseases, &c.

I. Mouth, Pharynx and Gullet. The gums, lips, hard and soft palates, the under surface and root of the upper surface of the tongue, the upper surface of the epiglottis, as also its membranous folds and the pharynx, are marked, to a greater or less extent, by an *aphthous* eruption (Pl. I, fig. 1), which is *not ulcerous*, as the subjacent membrane is entire.* The roughened and granulated aspect, as presented to the eye, is readily scraped off, and consists of *accumulated epithelium* collecting on the surface of the membrane *around the orifices* of the follicles, and thus giving a punctated or *honeycomb appearance* resembling minute ulcers. The lesion does not extend beyond the pharynx (back mouth), into the gullet† (which exhibits no trace of disease), or into the air passages. The scaly epithelium from the under lip of a diseased cow, as highly magnified, is presented in Pl. I, fig, 2, where some of it is rolled up into scrolls and cylindrical forms, and other parts show the proper flattened and nucleated appearance. There are also seen a few mucous corpuscles and some vegetable cells from the animal's food. The epithelial scales are very granular, showing the earlier processes of retrograde degeneration.

At the fauces there is intense inflammation, with an *effusion of lymph*, the parts being dotted over with a yellowish-white pigment. (From observations in Galicia, by Prof. Simonds, in 1857; 1st Rep., p. 5.)

The buccal membrane around the teeth is ulcerated looking, and stretching between each tooth is a kind of white secretion, which is easily removed and very fetid. Per W. Pallin, V. S., Sequel, &c., p. 53.)

II. The Stomachs. The first and second stomachs are generally loaded and distended with food, a circumstance which indicates their suspended functional activity. No change of structure is observed in either organ, and their lining membranes are not red-

* A like eruption, equally characteristic of the disease, is found at the external opening (vulva) of the vagina. (Pl. II, fig. 1.)

† The tongue is foul, with a greenish yellow deposit about its base, and this exudation sometimes extends down the œsophagus (gullet); so marked in one case that Gamgee was induced to make a water sketch of this somewhat unusual condition. (Gamgee's Cattle Plague, p. 58.)

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dened or congested.* *Per contra*, their membranes are friable, *infiltrated and blood spotted* here and there. (Egan.)

The third stomach, or omasum, exhibits, after careful search of its folds and in about *one-half* of the dissections, irregular † circular patches from the size of a pin's head to that of a twenty-five cent piece, which have bright red or scarlet margins, and in the larger patches inclose a central portion of a dirty yellow color and gangrenous appearance. (Pl. III, fig. 1.) This portion is slightly depressed, friable, quite bloodless, and the papillæ on its surface shrunken, especially towards the middle, but there is not any breach of substance. The bright color of the outer ring, as shown by the microscope, is due not to ecchymosis but to the confluence of the congested papillary vessels (Pl. III, fig 2), and thus explains the sharply defined marginate character of the patches. Their mode of extension is as follows: A single papillæ is first attacked and its vessels become extremely congested (Pl. III, figs. 2a and 2b), as in fig. 2a (of the natural size, being more distinctly seen under high magnification in fig. 2b). The dark spots at the apex of the papilla indicate commencing gangrene, while the effused blood, stretching from it in every direction in curving filaments, shows the mode of attack upon the neighboring papillæ. As the congestion extends, the central papillæ show a circle of dull gangrenous appearance, the outer papillæ are engorged to the highest degree of vascularity, forming the scarlet colored ring (Pl. III, fig 1,) and thus disorganization spreads from the centre to the circumference.

The third stomach is usually full to swelling; it is sometimes firm and sometimes soft to the touch, and in accordance therewith the contents are sometimes solid and dry (often so much so as to be capable of being rubbed to powder), in cake-shaped layers, squeezed together between the compartments, and sometimes merely damp, pappy fodder. In the former case, the mucous membranes lining the walls of the stomach appear in places ragged and loose and sticking to the fodder; in the latter case, the mucous membrane is very much softened and the surface skin easily removable. (Egan.)

* In protracted cases the epithelium of the rumen has been seen to detach itself readily, or to be already removed on first examination, and ulceration has been witnessed. Both in the reticulum (second stomach) and omasum is found, in some cases, a somewhat reddened mucous membrane beneath the epithelium, which sheds off too freely. (Gamgee's Cattle Plague, p. 59.)

† Such deeply reddened, more or less, circumscribed patches, have been observed by Prof. J. Gamgee in pleuro-pneumonia and cases of chronic impaction of the third stomach. (Gamgee's Cattle Plague, p. 59.)

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In some instances the purple circles so much spoken of can be observed, but it is a state which I believe exists also in other diseases. The epithelium peels off attached to the ingesta, which is found generally hardened between the folds, themselves injected, while the papillæ stand erect and prominent. (Pallin.)

The third stomach is affected with inflammation in patches. This inflammatory action often going on to a degree of intensity as ultimately to end in ulceration. (Simonds.) In most of the cases observed by J. Simon, there was considerably more affection of the third stomach than appears to be general, according to the German reports. The claret-colored patches and eventually sloughs were more frequent in England.* (1st Rep., p 43.)

The abomason, or fourth stomach, is reddened in the earlier stages of the disease only a little more than in health, but the color deepens as the malady progresses, and becomes dusky red, with interspersed claret-colored patches. (Pl. IV, fig 1.) Its lining membrane† exhibits the following deviation from a healthy state: First. Its attachment to the muscular coat is generally loosened, and at many points destroyed. Second. It is soft, easily breaks down under pressure, and where the change is furthest advanced, peels off, as if cohering mechanically to its sub-mucous connections. Third. Its epithelium is imperfect, and at many points quite absent, thus forming cracks on its surface. Fourth. The high color of the tissue, as microscopically determined, is due, not as has been stated, to sub-mucous or intra-mucous extravasation, but to *vascular congestion* in its most extreme form; the vessels being distended to their limits, but without rupture or dispersion of their contents unless artificially produced. Fifth. In some instances, generally in cases examined a few hours after death, some small ulcer-like depressed abrasions have been found. These are not true ulcers, and do not penetrate beyond the epithelium. In other

*The abrasion of the epithelial membrane is not a diagnostic sign of this disease; nor is the peeling off and adhering to the plastic surface of the food to be confounded, as has been supposed by some, with the erosion of the mucous membrane.

The epithelium undergoes constant change in health, and can be readily stripped from the third stomach of a perfectly healthy animal freshly slaughtered. (Smart.)

†This is swollen, especially near the pylorus, and there is a singular *mottled aspect*, when closely observed, from the grayish epithelial deposite in the glandular openings. Erosions and ulceration are not uncommon. Dr. Murchison says: "The membrane is studded with numerous minute superficial ulcers like those erosions which are so common in the ordinary catarrhal inflammation of the human stomach." (Gamgee's Cattle Plague, p. 59.)

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instances black spots, without breach of surface and evidently due to pigmentation, were met with. (Smart.)

In simple cases, the fourth stomach is the principal seat of disease; the natural yellow or brown color of it is changed to a dark or mulberry shade; the lining membrane is *thickened* and *corrugated*, and in cases which have been long suffering, there are often patches resembling ulceration. A careful examination of this stomach proves the morbid condition not to be the result of inflammation, but depending entirely on an intense capillary congestion of the mucous coat, which is found *raised and separated* from the muscular one beneath; - - - the peritoneal covering of the stomach is generally healthy, proving the non-existence of inflammation. (Pallin.)

The rennet stomach (laabmagen) and the thin guts (dünndarm) always exhibit the most striking change; on the outer surface they are more or less discolored, covered with livid spots and bare places, and when cut up the mucous membrane appears dark red, and covered with a tough adhesive slimy fluid, discolored, frequently of a greenish black. (Egan.)

In the fourth stomach there is intense inflammation of the villous membranes in patches, and every now and then you see spots of ulceration. (Simonds.)

III. THE INTESTINES. These show a like congestive vascularity, resembling the phenomena of muco-enteritis. Dr. Murchison's observations, however, make the inflammation of the small intestines usually most intense about the middle. The minuter vessels of the small intestines are completely injected, and can be seen by the naked eye in the aborescent forms of their intricate reticulations, (Pl. V, fig. 1.) When the capillary congestion is complete and is passing into the stage of destructive disorganization, there is shown a very characteristic mahogany appearance. (fig. 2.) In the large intestines the principal blood vessels of the mucous folds (rugæ) are mainly and in a higher degree affected, which gives to the gut a peculiarly striped aspect. (Pl. VII, fig. 3.)

In the duodenum we also find similar (inflammatory and ulcerous) indications of disease as well as in the other small intestines, particularly in patches; we observe now and then a tendency to ulceration or that there is *ulceration* of Peyer's glands; but it does not appear to be an *essential* of the disease in its early stages. In the larger intestines are seen similar lesions to those in the smaller, and

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more frequently ulceration in the apex of the cæcum. The rectum may or may not be inflamed. Simonds.

The vascular* engorgement increases towards the terminal portion of the canal and the mucous folds of the rectum exhibit the tumid and deeply purple appearance of internal hæmorrhoids. (Pl. IX, fig. 1.)

The entire canal of the intestines is more or less filled with fetid gases. (Egan.)

The ileum is affected similarly to the pyloric end of the stomach, thickened, &c. That intensity of these appearances recurs in the cæcum. Here the red patches are visible, varying in intensity along the course of the large intestines until they reach the rectum, which is evidently another favorite abode of the disease, which is thickened, discolored and ulcerated, in advanced stages. (Pallin.)

The whole mucous lining of the bowels is unduly soft and its epithelium imperfect. There are no true ulcerations as in the ulcerative typhoid of man. Not unfrequently a viscid fetid mucus covers the membranous surface. The bowel is usually empty or its contents are fluid and slimy. The discharges contain bile, and are sometimes tinged with blood. Occasionally they resemble the *rice-water stools* of cholera. The feculent matter contained in the intestines (Mrs. Nichols' cow) was fluid, stinking, and of a dirty white color. (Simonds.) The ileo-cæcal valve is, as regards function, healthy, but its lining membrane, as also that of the cæcal appendage, is involved in the general hypervascularity.

There is no sloughing or invagination of the bowels, nor any desquamation of its mucous surface in the form of casts. The intestinal glands do not share to any marked extent in the altered condition of the membrane, except that they are obscured by its discoloration. They are never ulcerated, but exhibit the chronic tuberculous condition frequently met with in healthy animals. The mesenteric glands show no leison of structure, but are bloodless and shrunken, and their lacteal vessels are generally empty.

IV. Kidneys, Bladder, Uterus, &c. The pyramids of the kidneys are usually congested; the cortex is pale, but the structure entire. The lining membranes of the bladder and urethra, never seriously involved, present only the appearances when the organs are con-

* There are *cases* in which the intestinal mucous membrane is *singularly free from disease*. There are others in which the general blood extravasation has undergone a similar change, and acquired the color and character of a melanotic deposit. In these cases there is simply an open perforated aspect of Peyer's patches, and in others these glands seem to have disappeared altogether. (Gamgee, p. 60.)

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gested. The uterus exhibits no peculiar feature; the state of the vagina, and especially of the vulva, being *highly characteristic*, the aphthous eruption, as observed in the mouth, being apparent at the junction of the mucous membrane of the vulva with the integument.* (Pl. II, fig. 1.)

The labia superiorly are dry and corrugated, inferiorly coated with discharges thick and putrid, which, when removed, shows the papillary eruption of an aphthous nature. (Pallin.)

V. HEART, LIVER, SPLEEN. The condition of the heart is not peculiar, but such as is ordinarily induced by many exhausting diseases. Its muscular substance is relaxed and flabby; there is no valvular lesion or structural change. Ecchymosed patches are sometimes seen on the exterior of the ventricles. On the inner part of the heart, and on the left side in particular, petechiæ were present. (Simonds.) The large vessels and their lining membranes are healthy. The liver is of natural size, pale in color, but sound in structure. [The liver is generally friable and of a clay yellow. Egan.] The gall bladder is usually filled with bile, which is thin and of a light green color, and rarely patchy discolorations are found on its lining membrane. [It is much distended with thin, yellowish gall. Egan.] In *one or two instances* in Galicia we found ulceration of the mucous membrane of the gall bladder, and effusion of lymph into the gall ducts. (Simonds.)

The spleen is too pulpy, and breaks down under slight pressure. The pulp is composed of broken down tissue and blood cells of a very dark color. It exhibits the same condition as in exhausting fever. The spleen is generally unchanged. (Egan.]

VI. WINDPIPE, LARYNX, LUNGS AND THORACIC CAVITY. The entire mucous membrane lining the respiratory passages is reddened and highly vascular, as in the earlier stages of acute bronchial catarrh. (Pl. IX, fig. 2.) It is sometimes nearly dry, but more frequently, especially in the smaller tubes, there is an abundance of frothy mucus (purulent—Egan) often of a slightly red color or tinged with blood. [It often appears to be free from inflammatory action, but is covered over with layers of lymph, frequently as thin as a sheet of paper. Simonds.] The membrane is entirely free of aphthous eruption, and there are but rarely indications of an effusive or depositive inflammatory condition. Exceptional cases have been

* The mucous membrane of the organs of generation is always red, tumefied, and the epithelium undergoing changes as seen on the mucous surface of the organs of respiration and digestion. (Gamgee, &c., p. 66.)

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observed in Vienna and by Professor Gamgee, where a considerable deposit was observed in the trachea.* Only one case is to be found in all the museums of Europe, where there has been, as in the exudation of croup, a solid fibrinous deposit in the trachea. (1st Rep., p. 110.) The air cells of the lungs in *uncomplicated* cases are healthy; any emphysematous condition being chronic and not superinduced by the disease. The lungs appear shriveled, pale or discolored, and sometimes much swollen. (Egan.) The serous membrane of the chest, as a rule, is likewise free from disease. (Simonds.)

VII. BRAIN AND SPINAL CORD. The cerebral membranes are much congested, not without vascular rupture or extravasation. There is no effusion on the brain, no congestion of the membranes of the spinal cord, the brain and cord being both perfectly healthy.

The brain gives no indication of disease; but in detaching the brain from the spine we found nearly in every instance in Galicia a larger quantity of fluid than ordinary. (Simonds.)

Dupries, in post-mortems made in 1795 and 1814, with special reference to the lesions of the nervous system, invariably noted the following appearances: The spinal marrow softer and more injected than in health, especially in the *lumbar* region, so that when touched it appeared to be mere pulp. Serum, limpid and transparent, was found in the duplicatures of its investing membrane in great quantity, more abundant in the lumbar region. The cellular tissue of the lumbar and sacral nerves, where they join the spinal cord, is ordinarily gorged with bloody serum, and in one case, in 1795, the nervous filaments were sprinkled with very small black ecchymoses. The brain is not so soft as the cord; most frequently it appears to be healthy; sometimes, however, more injected, and the meninges redder; the ventricles very often filled with an abundant lemon-colored serum. In one case Dupries saw the arachnoid dotted with little black ecchymoses also found on the plexus choroides. Gamgee found usually redness of the meninges of the brain, and deeper redness of the cord, especially in cases where the breathing was very labored during life; and on puncturing the dura mater four to six ounces of serum escaped.

VIII. URINE, BLOOD AND MILK. The urine in all cases contained

* Gamgee has drawn out of the bronchial tubes imperfect and friable casts made by exudation, which, when placed in alcohol, retained a considerable degree of solidity and firmness. In such cases the mucous membrane is all of a deep red color, with a dirty-looking deposit on its surface, and a complete destruction of the normal cilliated epithelium. (Gamgee, p. 57.)

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albumen in varying proportions, and in the majority of cases *blood cells* also.

The blood, as in most cases in the vessels of a dead animal, remains fluid for a considerable period after death. (It sticks peculiarly to the hand. Higgins, 1st Rep., p. 119.)

On analysis the blood was deficient in fluids and in its proper salts, with fibrine in excess. The blood of a healthy calf contained 4.53 parts of fibrine and 89.69 of corpuscles in 1,000 parts. After disease, which was slight and induced by inoculation the fibrine rose to 4.85 and the blood corpuscles to 117.7 in 1,000 parts. In a bad case the fibrine amounted to 9.9 in 1,000 parts. In three cases of analysis of urine the coloring matter of bile was present; in one bile acids were present, and in the same case examined for leucine and tyrosine; these constituents were not found. (A. Gamgee.)

The blood coagulates slowly but firmly out of the body. The clot resembles pitch, and in the fluid state of the blood has a somewhat tarry or porter like appearance (Pl. X, fig. 2) compared with (fig. 1), showing the color of healthy blood. The temperature of freshly drawn blood in an advanced stage of disease in a cow slaughtered was ninety-one degrees Fahrenheit, with specific gravity of fifty-nine degrees; the temperature of healthy blood obtained in slaughtering being the same, its specific gravity seventy degrees less. Under the microscope, the red corpuscles are small and shrunken, their cell walls also shrink and corrugate, and many assume a stellated form. They also cohere tenaciously, the white corpuscles are greatly in excess as compared with a healthy state, are swelled out, many ruptured and their granular contents dispersed over the microscopic field. (Pl. X, fig. 3, showing rinderpest blood compared with healthy blood in fig. 4.)

The milk, when drawn from a cow in an advanced state of the disease, is altogether creamy, resembling in some cases melted butter. It has a peculiar persistent taste, owing probably to a deficiency in sugar. It decomposes rapidly, and under the microscope consists of fatty cells crowded and overlaying one another. (Pl. XI, fig. 1; as compared with the appearance of healthy milk in the microscopic field, fig. 2.)

IX. TISSUES, &c. The serous membranes, when the disease has no complications, are healthy and with no effusion into their sacs. The cellular condition of the loins in some animals is highly emphysematous, a condition occurring frequently in life. But it is

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a dangerous complication; one of the cows under treatment died from *suffocation* simply from this cause.

X. UDDER, SKIN, &c. The structure of this last is unimpaired; the diminished secretion of milk is to be referred to systemic causes. In one-third of the cases examined by Dr. Smart, an eruption appeared *very generally diffused* over the *skin* * and most abundantly in the flanks. The eruption as seen in the udder had a vesicular character, making its appearance on the fifth to seventh day.

These eruptions were *papules* and not pustules, as observed by Dr. Thos. Hillier, M. D., medical officer of health (2d Rep., p. 33), though he did not trace the eruptions to their conclusion.

XI. FEET. The lining membrane † of the cleft of the hoof is very highly congested, with desquamation, &c., similar to the other external lesions of mouth and vulva.

XII. FLESH. This possesses a mulberry or dark claret color, with the remarkable quality of iridescence or of changing color. The color of the fat is of a dark and dusky yellow, becoming more marked after exposure to light and air. Both muscles and fat exhibit an unusual degree of shrinkage. (Pl. XII, fig. 1.) The muscle, however, after a period of exposure, loses the first characteristic distinction from healthy beef (Pl. XII, fig. 3), and the mulberry hue is insensibly changed for a reddened tint, still with an element of brown, which imparts a peculiar duskiness to it. (Pl. XII, fig. 2.) If the animal is slaughtered early in the development of disease, there cannot be detected any alteration in the carcass. (Higgins, 1st Rep., p. 119.) Prof. Brücke, of Vienna, stated that during a recent epidemic of steppe murrain, in Bohemia, the authorities, according to their practice, had the diseased beasts slaughtered and buried; but that the populace dug the carcasses up and ate them without any injury.‡ Similar accounts of plenty of cases are given in Levy's Traite Hygiene. (J. Simon.)

* The surface of the skin over the neck and withers is often moist or greasy, from an abundant sebaceous secretion. There are no vesicles and an entire absence, as a rule, of pustules. In some cases are seen somewhat flattened nodules presenting the characters of false cow-pox. Guersent, in his "Essai sur les Epizoötiques," speaks of this eruption in mild cases, &c., in the form of small eminences of conical form, analogous to false vaccine. Prof. Gerlach noticed this appearance rarely in Great Britain, but more frequently in Holland, where the disease was less virulent. (Gamgee, &c., p. 50.)

† The great capacity of this membrane for the diseased condition, naturally leads to the inference that it is highly capable of absorbing the virus from urine, dung and other exuvæ of Rinderpest subjects, with which it may be brought in contact.

‡ It is to be hoped that the food thus eaten was thoroughly cooked, so as to destroy the entozoa, which have almost invariably been found in animals dying of the cattle plague, and in much larger numbers than in the cases of healthy animals. For description, &c., of the animalculæ, see Appendix to Cattle Plague, p. 819.

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t is of considerable importance that we should state that of the ninety-eight cases tabularly reported by Dr. Smart, with the distinctive lesions which they revealed on dissection prior to the 11th of December last, thirteen were examined as distinctive cases of murrain or mouth and foot rot, and pleuro-pneumonia, ten of the former and three of the latter. It was deemed highly desirable to furnish a comparison of the lesions which these diseases cause, inasmuch as many of the cases of Rinderpest were found to be complicated with these and other fatal maladies; twelve with chronic pleuro-pneumonia, five with double chronic pleuro-pneumonia, five with pleurisy, acute and chronic, one with pulmonary apoplexy, &c.

The reddened aspect of the lining membrane of the fourth stomach in murrain is limited to the upper third of the membrane, never exhibits the purple or mulberry tinge, but is found associated with dark colored spots, which are sub-mucous hæmorrhages or apoplexies; the blood thus effused ultimately induces erosion of the subjacent membrane, while the epithelium is entire and the mucous membrane otherwise sound. The dark irregular patches seen in the membrane (Pl. IX, fig. 3), representing the hæmorrhages or apoplexies of the mucous membrane in murrain (or mouth and foot rot), are never present in Rinderpest, but have been found in all of Dr. Smart's dissections of murrain cattle. Though the mouth shows discolorations, or sometimes a single ulcer on the tongue, there is no reddened or abnormal affection of the vagina; while in most cases the intestines, lungs and air-tubes, and in all cases the heart, liver, spleen and kidneys, were healthy and sound. In pleuro-pneumonia, the principal abnormal signs are found in the lining membranes of the air-tubes, which are congested and thickened; in the lungs, either hepatized,* consolidated at the base, adherent to the investing membranes or with effusion; in the heart, dilated and relaxed, with adherent pericardium; and in the liver, spleen and kidney being more or less congested.

(II B. GENERAL PATHOLOGY.)

As before intimated, we dissent from the opinion so generally concurred in by those whose opportunities of examination and whose veterinary skill entitle their judgments to the highest respect, that the Rinderpest is identical with the epizoötics which

* In Rinderpest the lung is not necessarily diseased. A dull, solid-like sound is emitted on striking the ribs over a lung solidified from pleuro-pneumonia. In Rinderpest, when the lungs are emphysematous, the sound from percussion is still more resonant and hollow-like than even from healthy lungs. (T. Baldwin. Sequel, &c., p. 43.)

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have visited Europe and Great Britain for ages past. But we will not express this conviction without first conceding some fair apology for those who, against reasonable grounds of doubt, have been led apparently to coincide with the general current of opinion and authority. We may then, without also yielding our judgment, venture to prove from contemporaneous evidence, which has happily been placed before us, that the murrains of the last century are wholly distinct in their pathognomical indications from the distemper we are considering.

It is natural that there should exist in the popular mind a tendency to confound this pest with all others which in past ages have destroyed, and even up to the present time are desolating flocks and herds of domesticated animals, and generally known as murrains. But scientific minds refuse to indulge in this general confusion. We cheerfully record the fact that veterinary diagnosis is now happily so far advanced that it rarely happens that the pest is now, as it has been, identified with or mistaken for the following epizoötics which have obtained a foothold on the continent and in England, to wit: Eczema-epizoötica (mouth and foot rot), or pleuro-pneumonia-typhoica, or (by some writers styled) exudativa ; (contagious pleuro-pneumonia).*

Moreover, the terror which epizoötics as well as epidemics excite in a community where their extraordinary havoc is witnessed from hour to hour, indisposes even the most heroic to those patient modes of investigation, which can alone clearly define the nature and scope of the pestilence, and secure its ultimate mastery by remedial agencies.

Hence, we have the vaguest notions of most of those epizoötics which have scourged the continent and Great Britain for many centuries. The murrains in the latter, of 1348–9, 1480 and 1665, have left behind them but little note of anything but their fatality and rude attempts at sanitary regulation. Those, however, which were developed in the eighteenth century, had the advantage of no inconsiderable skill in their investigation. And we cannot but express our reluctance to state, that the Royal Commission have given the sanction of their high authority to the endorsement of the opinion, that the Rinderpest is identical with the murrains of 1714

*We may regret that the latter disease, imported a few years since from Holland into Massachusetts, was regarded, in terms at least, as mere pleuro-pneumonia, which is enzoötic or sporadic. The pneumonia which effected no inconsiderable loss, and threatened an extended alarm throughout this country, was finally put at bay, and is now understood and recognized as typhoid in its distinctive character.

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and 1745. As there exists sufficiently accurate descriptions of the morbid anatomy of these distempers, and as the question of identity is of importance, not only as a matter of history, but of diagnosis and therapeutics, we shall offer no apology for the space devoted to the review of post mortem and other examinations, made during their prevalence, which, as we think, clearly demonstrate a total want of identity. Perhaps, however, we ought to acknowledge two common facts in the epizoötics of 1714 and 1865. Each first made its appearance at Islington, and about the middle of July.

Thomas Bates, Esq., F. R. S., and surgeon to his Majesty's household, was appointed by the Lord Justices to investigate this plague of 1714, and he has presented, in his paper* read in 1718 before the Royal Society of London, a very clear pathological view of this distemper. He alludes in his report to the pestilence of 1665, resulting, as was believed, from "a want of due care in burying the cattle" who perished the year before, and insists upon burial† to the depth of nine or ten feet. He states the mortality in three counties in 1714–15 at nearly 6,000, and the loss (prime cost) at £24,500. He limits the period of the severity of this plague to three months, though "it was not entirely suppressed until Christmas," and alludes to its‡ raging in Holland for three years, at a loss of over 300,000 head of neat stock.

The following symptoms were furnished to Dr. Bates by the cow-keepers, who had lost from over one-half to seven-eighths of their stock:

"The cows first refused their food. The next day they had *huskish coughs* and voided *excrement like clay;* their *heads* swelled, and sometimes their bodies. In a day or two more there was a great discharge of mucous matter by the nose, and their breath smelled offensively. Lastly, they had severe purging, sometimes bloody, which terminated in death; . . . . some died in three days and others in five or six days, but the bulls lived eight or ten days; . . . . during their whole illness they refused all manner of food, and were very *hot.*"

* See Philosoph. Trans., No. 538, p. 872; Vol. VI of Abridgment, p. 375.

† Burying with lime, two bush. to a cow, ten feet deep, developed a strong scent of meat, which attracted dogs, and caused them to tear up the ground with their feet—otherwise where the animals were buried at less depth and without lime. Philosoph. Trans., Vol. XI of Abridgment, p. 255.

‡ This might serve if no other proofs were presented as indicating the epizoötic on the continent and Great Britain as one and the same during this epoch, and the observations of Lancisi as well as the treatise of Rammazina, we think, confirm the presumption.

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Bates ordered the slaughter of all cattle and disinfection of the premises. But the distemper, owing, as he thought, to the "free intercourse which both masters and servants had had with each others' cows," had "spread the contagion."

He subsequently dissected sixteen cows in "different degrees of infection," first five, in whom the "symptoms were just become visible;" then six that had "been ill about two days," and five that "were very nearly dying."

In the *first* set "the gall bladders were larger than usual, and filled with bile of a natural taste and smell, but of a greener color. The pancreas was shriveled; some of the *glands* were obstructed and tumefied; many of the glands in the mesenteries were twice or thrice their natural size. Their lungs were a little inflamed; *all other parts* of their viscera appeared as in a *healthful* state." In the *second* set the following differences and aggravations were found: "The *livers* were *blacker* than usual, and in two of them there were several cysts filled with a petrified substance like *chalk*, about the size of a pea; gall of a greener color than the first. Some of the glands were very large and hard; the *mesenteries five times* their natural size, and all of a blackish color. Lungs inflamed, with several cysts forming. Their intestines were full of red and bluish spots. Their flesh was very hot, though not altered in color." In the *third* set he noticed the following changes, to wit: "Liver now much shriveled and contracted, and in three of them there were several cysts as large as nuts or nutmegs, filled with a petrified substance like chalk; gall bladders three times their usual size, &c.; mesenteric glands, eight or ten times their natural size, were very *black*, and in most of those glands in the pelvis of two cows there was a *yellow petrifaction* of the consistence of a *sandstone*. Intestines of the color of a snake, their inner coat excoriated by purging. *Lungs* more *inflamed*, with *cysts* containing *yellow purulent* matter, many as large as a nutmeg."

The dissections of these three classes of subjects were quite uniform; but Bates notices three cases as "very extraordinary" —one in which "the *bile* was *petrified* in its vessels, and resembled a *tree of coral*, but of a dark yellow color and brittle substance." In another "were several inflammations on the liver, some as large as a half-crown, cracked round the edges, and appeared separating from the second part, like a pestilential *carbuncle*." In the third, "the *liquor contained in the pericardium* appeared like the sub-

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sidings of aqua calcis, and had excoriated and given as yellow a color to the whole surface of the heart and pericardium as aqua calcis could possibly have done."

Aside from the admitted fact that this pestilence was both infectious and contagious, and that the virus was communicated in very many cases by fomites (the clothing of attendants, &c.); physiologists, we believe, will find little resemblance between the symptoms and dissections of this distempter of 1714 and those of the Rinderpest. Neither do we think that the pest can be identified with the epizoötic,* which ravaged parts of the continent from 1744 to 1772; and England from 1745 to 1757 (again breaking out in 1765); although Professor Simonds, a very high authority, seemingly abandoning the position taken in his report made in 1857, to the National Agricultural Societies of Great Britain, on the plague which was then very fatal in Eastern Europe, has in his evidence before the Royal Commission of 1865 (1st Report, p. 2, § 16) stated that the plague of 1745 was the same as that at present existing in England.

Professor Simonds in his report,† speaking of the murrian of 1714, says:

"It appears, however, that the malady possessed many of the features of *Ecxema epizoötica* now common in this country, and it may possibly have been identical with this disease. The infection seems to have been communicated by the saliva, as it is said that 'when this is dropped on the grass, and sound animals are immediately placed on the same pasture, they contract the disease, and in some bullocks the tongue was inflamed and covered with many red blisters.'"

And, again alluding to the singular exemption which Great Britain enjoyed after the subsidence of the latter epizoötic, until August, 1859, mentions the great anxiety which was created by—

"The sudden and almost simultaneous appearance of a 'new affection' (although probably of the same nature as that of 1713–14), amongst the cattle in different parts of the country, popularly known as the mouth and foot disease."

* There were destroyed in Western Europe from 1711–14, one and a half millions of cattle, and from 1745–8, three millions in Western and Central Europe. These statements are believed not to have been exaggerated by the foreign authors who furnish these statistics, giving as the loss of Denmark, from 1745–9, 280,000 head, and of Holland, from 1769–72, 895,000 head.

† See Journal of Royal Agricultural Society, Vol. xviii, pp. 197 and 200.

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The Professor also refers to Dr. Layard's Essay* on the epizoötic of 1745, as to the opinions prevalent at that time (and quoted by Layard from Dr. Mortimer) on the origin of the disease, whether brought by imported calves from Holland, or by distempered hides from Zealand; but he seems latterly to have overlooked the pathology of the disease as described by Dr. Layard.

This learned physician inclines to the opinion that the distemper of which he so elaborately wrote was similar to that visited upon the obdurate Pharaoh, 1,600 years B. C., which resulted in the destruction of all the cattle in the fields; horses, asses, camels, oxen and sheep, by a very grievous murrain, "*boils* breaking forth with *blains* upon *man* and beast." Adverting to the great plague which, after destroying, in the days of Romulus, the fruits of the earth and cattle, swept off many of the *Romans and Laurentes;* quoting Livy, who identifies the disease as equally affecting men and brutes; a recurrence of which took place A. U. C. 355; Layard passes to the authority of Columella, Gesner and Aldrovandus, who described the disease as a sub-cutaneous disease; makes it a plague of the same kind which destroyed "every head of cattle in Charlemagne's army, ... also throughout all his dominions;" and rallying upon the account given by Rammazini of the distemper in Germany and Italy in 1514 and 1599, winds up with this general expression of his historical survey:

"The same countries which breed the plague and small-pox seem to have propagated this contagion. The autumnal heats in Asia or Africa, the putrid effluvia from the Nile, or from corrupted, stagnating waters, are sufficient to contaminate the blood and juices of the cattle." (Page 13.)

This presents, it is true, a theory of the identity of cattle murrains through all historic periods. As a generalization broader in its grasp than the one we are combating, we shall leave it to rest upon the evidence it brings from the records upon which it relies; or the imaginative skill with which the eloquent Doctor has grounded this universal pestilence on its effluvial origin. The pathology of that which he saw, is more to our present purpose. After describing the usual symptoms of sudden debility which manifest themselves in most cattle affected with blood-poison or ferment of any kind, he notices:

* See an essay on the nature, causes and cure of the contagious distemper among the horned cattle in these kingdoms, by Daniel Peter Layard, M.D., Mem. Roy. Coll. of Physicians, and of the Royal Society, 1757.

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"A constant diarrhœa of fetid green fæces, a stinking breath, nauseous steams from the skin, blood *very florid*, hot and frothy urine, or stale, high-colored; roofs of the mouth and barbs ulcerated, *tumors or boils* felt under the *panniculus carnosus* or fleshy membrane of the skin (note reference to Rommazini and Lancisi), eruptions all along the limbs and about their bags (note reference to Aldrovandus, I, 110, De malide Subtercutanea), visible irritation during some time *in ano*, much groaning, symptoms aggravated in the evening, animals mostly lying down." "The symptoms continue increasing till the seventh day from the invasion, on which generally, though sometimes protracted till the ninth, the *crisis* takes place."

Now, we will admit that some of these symptoms might present a difficulty in distinguishing between themselves and those occurring in Rinderpest; but the Doctor, in his chapter on prognosis, clears up every doubt or mystery.

"If, therefore, the following symptoms be observed on the seventh day from the seizure, namely, either eruptions all over the skin or boils as big as pigeon's eggs on different parts of the body, but especially from the head to the tail, all along each side of the spine or backbone and tail, so ripe as to discharge putrid and stinking matter; large abscesses formed in the horns or in some parts of the body, &c, &c., the nose be sore and scabbed, &c., &c., the breast is out of danger. But, on the contrary, on the seventh day from the invasion the eruptions, boils or abscesses are decreased in bulk, or totally disappeared without having broke or discharged outwardly, &c., &c., the running from the eyes and nose lessened; the eyes dim and sunk into the head, a perfect stupidity, the beast inevitably will soon die." . . . . "Within some hours of its death, there frequently arises on the back, upon the sinking of the small swellings, a large tumor, or bag, filled, as it were, with air, pressing upon which the contents will move to and fro from the head to the tail. This is not only mentioned by Rammazini, but also by authors who deemed the disease to be only an inflammatory fever; it is called an *emphysema*," &c.

The term "emphysema" was evidently intended by Layard (if not as synonymous with that, immediately preceding, "inflammatory fever"), to serve as an expressive designation of the "large tumor, ... filled with air," which supervened in a *fatal* resolution of the malady he observed. Gamgee, however, who is a zealous advocate of the theory from which we dissent, quoting at

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length the passage from Layard, which precedes his prognosis, and omitting the latter; in a note-comment on the "tumors or *boils* felt under the panniculus carnosus," &c., declares these to be "evidently the emphysematous swellings" described by him as apt to form within the first three days after the external symptoms are manifest, and about the stage of the disease when severe diarrhœa sets in and thirst supervenes. It is clear, however, that the term "boils" was used in the unsophisticated sense of that term.*

But what says Dr. Layard of the morbid appearances which were presented on dissection. We will note most of those characteristic of the malady of 1745.

"The membrane of the nose (note Rammazini, p. 458), the glands (note Lancisi, III, 11), the whole extent of the *frontal sinus*, the pith of the horns highly inflamed, ulcerated and full of small abscesses; the same appearance in the mouth and about the glands of the throat. The lungs inflamed with livid sphacelated spots and here and there loaded with hydatids. The heart large, flabby and dark colored, containing in its ventricles clots of black blood, of a very loose texture without *serum*, the fat about it of a bright yellow. The liver large, its blood and biliary vessels fully extended with dark fluid blood, and very deep colored bile; the substance of the liver so rotten as to separate on the least touch; the gall bladder stretched to a great size and full of greenish bile; the œsophagus ulcerated in some. Several marks of inflammation and gangrene appeared on all the stomachs—all the intestines empty and beset with *red* and *black* spots. The kidneys and bladder large, without urine; the kidneys of a loose texture, easily torn. The flesh in some was livid, in others of a lively red, but soon turned green. The fat that remained was of a bright yellow all over the body. In such cows as were with calf the uterus was gangrened in several places, and the waters which surrounded the fœtus or calf stunk intolerably. In short every carcass gave sufficient evidence of a general putrefaction," &c.

It should be noted that the italics are those applied by the learned Doctor mostly to his Latin terms. We have refrained from underscoring the symptoms and morbid anatomy of this species of *anthracoid* plague which, unless we are greatly in error, places it "toto cœlo" in the constellation of epizoötics from the Rinderpest.†

*Cattle Plague, pp. 48–52.

†We note that Gamgee, in objecting to the title given to the Pest by Dr. Budd, "The

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If, however, it should seem that Layard's account is not as explicit in establishing the diversity between the distemper of 1745 and the pest, as that of Bates, with reference to the murrain of 1714; it will not be a difficult task to supplement the evidence by a concise review of three papers on this subject, read before the Royal Society* by Cromwell Mortimer, M. D.; premising, however, that his first might, in some respects, have misled Layard, as it seems to have led astray some of his readers in later times. The description which is given in his earliest account of animals, observed to be ill (that on "the very first day they have a huskiness, breathe short and wheeze, but have no great cough. . . . . Some lay down their heads and run much at the nose. . . . . The second or third day most of them fall into a purging; groan much and seem to be in great pain. The stools seem to be bilious; have cakes of jelly come away with them, and some were streaked with blood. They soon died after these stools came on. Those that are kept out in the cold air seldom lived beyond the third day; those that are kept in warm houses and clothed, live five, six and seven days. Many of the cows have a wild stare with their eyes; the whites of the eye and the skin of the eyelids looked yellowish; their tongues looked white; they had no extraordinary heat in their mouths, or at the roots of their horns [a place where they usually feel to judge of the heat of cattle], or in the axilla or arm-pit. The mucous running from their nose is very thick and ropy; their milk is thick and yellow"), might have deceived those who did not carefully study the post-mortem given; notice the fact, that the description of symptoms while suffering under the malady, and of the appearances found in dissection, was taken at second-hand by Mortimer, from one who had *flayed* and opened the two cows particularly described in this paper (although the unprofessional demonstrator stated that "these were the general appearances in most he had *flayed;* only that in some he found water in the cells of the horns"), or stop to meditate upon Mortimer's pathological summary, "that this distemper *began* by an *inflammation* of the

Siberian Cattle Plague," says: "It is apt to lead to confusion with the Siberian Boil Plague, an enzoötic rather than an epizoötic disease, a form of anthrax which never spreads beyond the Russian dominions, and which is unknown in healthy districts, even in Siberia itself. The Siberian Boil Plague attacks cattle, but principally men and horses; and although there are at times wide-spread outbreaks, these occur under the influence of excessive heat during the hottest months of the year, &c. (Cattle Plague, p. 23.)

* See Transactions for 1745, No. 477, pp. 532 and 549; No. 478, p. 4; Vol. IX of Abridgment, pp. 171, 177 and 184.

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lungs, attended with a catarrh or flux of humours from the nose; that in the progress of it there came on an inflammation of the guts, and a purging, caused by an acrimony and overflowing of the gall, which ended in stools tinged with blood—exciting great pain in the bowels—and brought on death."

The more careful reader of his second paper would have reasonably inclined to place due emphasis upon Mortimer's descriptions of those *post mortems* conducted under his own experienced eye. He was present when three cows were examined; *the lungs in all* were inflamed and blistered, &c. But not content with these dissections, he procured the services of an ingenious apothecary . . . to help him in examining everything *very carefully.*

But let us give the Doctor's luminous account of what was displayed, and as fully at length as it is given in the abridged edition of the Transactions of the Society:

"When the skin was taken off, she appeared very fat; the muscles, looked of a darker color than usual. On opening the abdomen the caul appeared very fat; the paunch was greatly distended; on making a puncture much air gushed out; it had in it a great deal of food; the inside looked well and did not peel; the second and third stomach, or the omasum, as also the fourth stomach, or abomasum, were almost empty, but looked *well;* the liver was firm, well colored and sound, except a few *scirrhous knobs* about the size of nutmegs; the gall bladder was exceedingly large, and full of very fluid gall; the guts were inflamed in many places; the *colon* and *cœcum livid;* he had the curiosity to have them measured; from the anus to the insertion of the cæcum there were twelve yards (the cæcum was an ell long), and from the cæcum to the pylorus there were fifty-two yards. The *midriff* was much *swelled* and *inflamed;* the *lungs* were *swelled, inflamed, adhered* in some places to the pleura, and almost wholly covered with bladders of water; there was no appearance of any inflammation in the pleura, or in either the internal or external intercostal muscles; the *windpipe* was *inflamed greatly* throughout its whole course, *especially its inside,* but the gullet, which lay so near it, was not in the least inflamed; the heart was of its natural size; the pericardium full of very fluid blood, probably from the bursting of some branch of the coronary artery, caused by the extraordinary accumulation of blood in the right ventricle, for the vena cava and right ventricle of the heart were turgid and full of black coagulated blood, though this cow had been dead but twelve or fourteen hours; the *lungs were likewise*

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turgid with blood, but little or none was found in the left ventricle or aorta; the obstruction seemed to have been so great in the lungs that very little blood could pass through them from the right to the left ventricle of the heart, and therefore evidently evinces the existence of a *confirmed peripneumony*. All the membranes lining the nostrils, and the spongy bones there, were quite turgid with blood and in the highest state of inflammation." He had not seen in any cows he had examined any cutaneous sores or exulcerations, nothing like the boils, carbuncles, &c., described by authors as the constant concomitants of the plague in men; nor does there seem to be any attempt of nature to fling off the distemper by any internal imposthumation or discharge, unless by the running at the nose and by the bilious stools or bilious urine.

After noticing a few cases of recovery through occasional bleeding, warm mashes of malt and bran, and warm drenches of herbs, such as rosemary, wormwood and ground-ivy, with honey or treacle, and regretting that his instructions as to treatment, &c., had been so poorly followed by the cow-keepers, he proceeds with his method of treatment, after reiterating his previously assured opinion:

" . . . . The state of the disease seems so evidently to be a *peripneumony*, or inflammation of the lungs, *windpipe* and *nostrils*, attended with a redundance of gall . . . . "

He next gives the symptoms of a favorable resolution of the distemper, on which so much reliance has been placed, because of the parallel citation made by Layard in a note to page 54 of his treatise, from Rammazini (p. 462), "that not one of the cattle recovered but such as had pustules broke out upon the skin;" also quoted by Dr. Murchison to establish his theory of the identity of the pest with human variola.

"They are observed to have scabby eruptions come out in their groins and axillæ that itch much; for a cow will stand still, hold out her leg, and show great signs of pleasure when a man scratches these pustules or scabs for her."

After seeking in vain to satisfy his mind as to the distemper being propagated through certain kinds of food, green or dry; being in doubt whether its cause was in the air or attributable to the changes of the season, as to moisture and cold, he affirms his clear conviction on one point:

"This was certain, the *viscera* concerned in *respiration* are the parts *chiefly* affected.

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In his third account he gives "an instance of the most surprising quick progress of this distemper . . . . not come to the state of purging," the case of a cow, in which the inflammation in general was greater than in any he had before seen; which had, under the specific treatment then mostly relied upon, not only as a curative but prophylactic, been bled about three weeks before she was taken, and once as soon as taken. The autopsy was as follows:

"The caul was greatly inflamed, the paunch inflamed, and the inner coat peeled off, especially that of the (abomasum) faidle; the guts were all inflamed; the liver was much inflamed in some parts, in others was turned livid; the gall bladder was very large, and the gall very liquid; the *lungs adhered* in many places to the pleura, were greatly inflamed and *turgid with blood*, and were in many places quite *black;* he did not find any of the watery bladders on the surface of these as he did on all the others he had seen opened."

If the examination we have given to Bates' autopsies, Layard's treatise, and Mortimer's papers may seem to have been unduly extended, we must seek our apology in the conclusive evidence thus furnished, negativing the dictum of the Royal Commission that the rinderpest had appeared in England prior to its introduction in 1865.

Making due allowance for any attributable imperfection in the accounts given by those who may not have possessed the same accuracy of descriptive power attained by modern pathologists, it is beyond reasonable conjecture that those who saw only epithelial denudation of the fauces should have described *ulcerations* and *abscesses* involving even the *glands* of the throat, sometimes the *œsophagus*, extending to the *lungs*, and inducing in the *liver* a general *rottenness;* and all this while the same tendency to the development of purulent abscesses being exhibited in all the external tissues.

There seems, in the descriptions of Layard, of the distemper of 1745,* hardly a symtom or post-mortem appearance to be viewed

* The distempers of 1711 and 1745, as malignant and contagious epizoötics, may find *their type* in the enzoötic disease commonly called quarter-ill or murrain, in which, from bad food, impure water, or other causes, the hepatic or cystic ducts, either separately or conjointly, and in combination with the ductus communis choledochus, are obstructed; producing an enlargement of the gall bladder, and, in connection with a congested affection of the liver, forcing an absorption (by the method of osmose) of vitiated biliary secretions into the blood; thus inducing the primary symptoms as well as final results of such too copious an infusion of purulent matter. We do not allude to concomitant symptoms, such as the destruction of muscular substance in the glutœri, &c., and the formation of large cells of vitiated blood corpuscles in their places; neither do we design in presenting in the

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as in common with those of the pest, except those which necessarily attend all inflammatory action. Even the fat in all parts of the system remained of a *bright yellow*, and the flesh soon turned *green*. Should the plea be interposed that, in the cases described by Dr. Mortimer, the pneumonic symptoms overshadowed the current epizoötic, the reply is fairly to be made, that Mortimer, who was as learned an expert as the medical profession of his day could produce, does not, if his statements are fairly canvassed or credited, admit or support the possibility of the existence of any other primary affection than that embraced in and bounded by the pneumonic congestion. And if this had a marked tendency towards a typhus form, it is not so difficult to account for the exacerbated manifestations on the intestinal canal in some cases he has described, as the result of the depletory and purgative treatment pursued.

If, however, the most subtle analysis of the opinions of Mortimer and Layard should reveal discrepancies, these we think will be mainly on minor particulars; and cannot disguise the dilemma in which their successors in veterinary pathology are placed, who have by hasty deductions formed on garbled statements of the views of these writers, sought to sustain the theory of the recurrence of the English murrains of the last century, and their re-appearance in this.

But we are disposed to move to a further standpoint, and to add that if the English writers could confuse or mistake observations on malignant distempers occurring in their own country, within the period of a century and a half; it is a fair inference that continental and classic writers may have labored under similar misapprehensions in regard to the identity of the various pests which have devastated flocks and herds in different ages.

On mere grounds of probability, we might impeach the calculation that during the last century alone. twenty-eight million head of cattle in Germany; and in the whole of Europe, including Russia, but excluding Siberia and Tartary, two hundred millions had fallen victims to the Rinderpest, (as these statements are presented in a report to Her Majesty's government, by Mr. Blackwell, British vice-consul at Lubec); when we consider that Europe has been afflicted with epizoötic hydrothorax, dysentery and catarrhal fever, in addition to the other distempers we have before enumerated, and

enzoötic form a countertype to the epizoötic, to assign a common or any original cause for their separate developments. All such theoretic views must be referred to future scientific investigation.

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one prevalent in Hungary, called blood plague (2 Rep., 29); and that her cattle, as well as human population, in many localities, have suffered great mortality in bad seasons for maturing and harvesting crops; from damaged, sprouted or ergotized* grain.

Now while we are in hand, let us push this investigation to remoter regions and times, and enquire what reasons exist for imagining that the distempers which scourged the continent for a hundred years, commencing at the latter part of the seventeenth century, were in any important particulars, physiologically akin to the Pest.

Rammazini, so often quoted in affirmation of this view, has left in his dissertation on the distemper which broke out in the Venetian territory, especially in the neighborhood of Padua, but a meagre substratum on which to found any such hypothesis. Nay, those who labor to pervert his views to any such end, must deny to him the right or ability to present or maintain the conclusions he favored. His tractate, far from being as voluminous as that of Lancisi, is clear, though terse in its pathological summary, and bears the marks of a scholarly and independent thinker. Refusing to be guided by the astrological lore, in which he had been instructed in his youth; discarding all reference of that cycle of malignant diseases of which he wrote to any ill-starred conjunction of Saturn and Mars, he avowed himself as the advocate of a rational system in medicine, and evidently seeks to conform his style of reasoning to that of the inductive school. True, he was misled by that which he gives as the most definite pathognomonic mark; so often cited of late to prove the theory of the variolous character or of continuous outbreaks of the pest, and its recrudescense at the present time: "pustula quinta vel sexta die per totum corpus erumpentes, ac tubercula variolarum speciem referentia." He viewed the distemper as mainly eruptive and pustular, and styled it "The Cow-pox Plague." And it is to be urged on grounds of just reasoning, that he was borne out by what he observed in viewing it as an inflammatory and phlegmonous disease, if not in the parallel he sought to draw with variola; and that with his clear perceptions and sturdy diagnosis he could not have counfounded it with any distemper such as the pest. His general description is "that it was a malignant, pestilential fever, accompanied by rigors, followed by a *burning heat*,

* By this phrase "ergotized," we mean to denote the parasitical growth of *all the fungi* which infest cereals, &c.

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quick pulse, *difficulty of breathing*," &c.* But what light is thrown upon the pestilence by his examinations of the carcasses of those who fell victims to it?

"It was particularly observed that in the omasus or paunch, there was found a hard, compact body, *firmly adhering* to the coats of the ventricle, of a large bulk, and an intolerable smell; in other parts, as in the *brain*, *lungs*, &c., were several *hydatides*, and large bladders, filled only with wind, which being opened gave a deadly stench; there were also *ulcers* at the *root* of the *tongue* and *bladders* filled with a *serum* on its sides. This hard and compact body, like *chalk*, in the omasus, is the first product of the contagious miasms."†

This description corresponds tolerably well, both in the sketch of living symptoms and the autopsy of the dead, with two other accounts; one by Michelotti, of the same murrain described by Rammazini, and one by Wincler, of the plague which preceded it.

In the year 1682, on the border of Italy, there arose a distemper among cattle, which spread into Switzerland, Wirtemburg and other provinces of the empire, extending at the observed rate of nearly two German miles in twenty-four hours until it reached Poland. Its march was without intermission; no neighboring parish escaped. It was a complete desolation.

"It seemed to propagate itself in the form of a blue mist, which fell upon those pastures where the cattle grazed, insomuch that whole herds returned home sick, being very dull; forbearing their food, and most of them would die in twenty-four hours. Upon dissection there were discovered large and corrupted spleen, sphacelous and corroded tongues, and some had *angina maligna*. The *persons* who carelessly managed their cattle, without a due regard to their own health, were themselves infected, and *died like their beasts*. The method of cure was this: "The tongue was carefully examined, and if they found any *aphthæ* or blisters, whether *white*, *yellow* or *black*, they were obliged to rub, scratch and tear the tongue with a silver instrument until it bled; they then wiped away the blood and *corruption* with new unwashed linen. This done, a lotion for the tongue was used, made of salt and good vinegar."

The antidote and remedial prescription were the same.

"Take of soot, gunpowder, brimstone, salt,‡ equal parts (a large

* Rammazini Ed., 1716; Geneva, p. 787.

† Philosoph. Trans., No. 338, p. 46; Vol. VI of Abridgment, p. 79.

‡ Doubtless Mr. Needham, taking the popular side of the theory of identity of murrains in modern times, and ascertaining from continental veterinaries that salt was the sovereign

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spoonful for a dose), and as much water as is necessary to wash it down."

Michelotti was eye witness of the greater part of what he described, having been in the Venetian territories about October, 1711, and received the rest on the spot from persons of integrity and credit. His account bears the stamp of his extensive skill and repute as a doctor of medicine. We shall give it quite at length:

"Almost all the sick cattle refused every kind of food and drink; they hung their heads, had shivering in their skin and limbs, they *breathed* with *difficulty*, and their *expiration* in particular was attended with a sort of *rattling noise;* they were so feeble that they could scarcely go or stand upon their legs. Some few of them eat a little and drank very much, others had fluxes or excrements variously colored, of an offensive smell, and frequently tinged with blood; many of them had their *heads* and their *bellies* swelled in such a manner, that in clapping them with the hand on the paunches, or along the vertebræ of the loins, they sounded like a dry bladder when full blown. In some the urine was very turbid in others of a bright flame color. In comparing the pulses of the sound cattle with those of the diseased, he found the latter to be quicker and weaker. There was but little heat perceivable by the touch in any of them; their tongues were soft and moist, but their breath was exceedingly offensive. Besides these particulars, he was *informed* by those who attended the sick cattle, and by other persons worthy of credit, that in some of the beasts they had observed *crude tumors* in several parts of the body, and also watery pustules, and disorderly motions of the head, with *dry black* and *fissured* tongues; that in others there were tumors which came to *maturation* with *putrid* matter issuing from the mouth and nostrils, *worms* in the fæces and in the *eyes*, *bloody sweats* and shedding of hair."

The pathological description follows:

"In comparing the flesh of the cattle dead of the distemper with that of others killed for the market, he found the *muscles* in the former, lying immediately under the skin, to be something *livid.* Having opened the three cavities of the body, he applied himself with the utmost diligence to examine the brain, with its men-

remedy, was induced, in his elegant essay, read at Brussels in 1776, to recommend this agent as the specific remedy for the murrain of 1745, a view which Layard proceeds to refute in his letter to Joseph Banks. Philosoph. Trans. *ubi sup.*, and Cattle Plague, p. 305.

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branes; the trachea, œsophagus, lungs; heart, with its auricles, the vena cava, aorta, and diaphragm; the liver, spleen, and other parts of the lower belly; in *all* which there was no *discernible difference*, either as to figure, size, contents, situation or connection with the neighboring parts, from what was observed in *sound* cattle killed by the butcher, except the particulars hereinafter mentioned. The *blood* found in the ventricles of the heart, in the pulmonary vessels, in the aorta and cava, though still warm, was considerably *blackish*, and *almost coagulated*. In opening the upper and middle cavity, the scent was offensive, but tolerable enough; whereas that proceeding from the lower belly was quite intolerable. In some *few* carcasses the *viscera* differed from the *natural* state, with regard to their size, their consistence, their contents, color and smell. In *several* the *paunch* was found very much *contracted* and *dried*, and contained a hard substance. In others the lungs were *swelled* and *lived*, the *liver tumefied*, and the *brain watery* and *putrid*. Having ordered several of the cattle to be blooded, he found the blood not to issue out of the vessels in a continuous stream, but with a broken and interrupted flux, one part of it not immediately succeeding another . . . . He found it entirely coagulated without any separation of the serum, and attached to the sides of the vessels with a reticular pellicle in the surface exposed to the air. Of the eighteen who were bled, all died within a few days, except one which underwent the operation on its first being taken ill."*

The symptoms and post-mortem appearances, as given by Michelotti, tally so well with those described by Lancisi, that here forbearing to reserve space for them, though somewhat tempted; we will give them in an appendix to our classical and curious readers in their original text; with some quotations also from Rammazini, not merely to show the exact relation which certain sentences generally quoted bear to the whole description, but to leave the critical in such matters to measure the unfairness, the reckless readiness, or the o'erweening zeal with which such citations have been used.

Had it not been necessary to summon the principal witnesses (men of erudition and renown in their age) with their entire declarative testimony, without perversion or gloss from hasty criticism; that this investigation might be a thorough and impartial review of the distempers they observed: we might have been con-

*Philosoph. Trans. 1720, No. 365, p. 83. Vol. VI of Abridgment, p. 481.

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tented with a summary of the English distempers given by an admirer of Layard, who has preserved its ancient but quite forgotten synonym, Hyanstricking, a corruption, doubtless of an Anglo-Saxon term, compounded of Hyan (cattle disease) and stric (plague) or strika (a stroke), indicating in the compound, either cattle plague or disease by which cattle are suddenly *stricken;* from which we may infer that our Anglo-Saxon ancestry were not free in remote periods from an outbreak of pestilence among their stock.

In an appendix to a posthumous work on diseases of cattle and their cure, by J. Rowlin, a veterinary surgeon of considerable eminence, a century ago, an account is given of this distemper, in which the one in 1745 is distinguished from the one of 1765; the common *external sign* of the former being "*blotches* arising all over the body," and of the latter the symptoms "in the roots of the tongue or glandular parts of the throat." The one is also described as an *emphysema*, or a flatulent crackling swelling, attended with a *mortifying blackness.* In the other the primary symptoms are said to be evident "by the mouth being generally open, and a *matter falling* therefrom; by opening the mouth you will find on one or both sides of the tongue a large *blackish* colored substance, which will easily yield to the pressure of your finger."

In fine, if we undertake to separate from any authentic list of the symptoms and morbid appearances of the murrains which scourged the continent as well as England in the seventeenth and eighteenth centuries; in the first instance, those which are peculiar to and accompany all deadly distempers of cattle; and next those which indicate primary and idiopathic affections of the lungs, or constitute the invariable signs of catarrhal fever; what is there left on which to base any diagnosis of a malady which, in its uncomplicated form, does not touch a single serous surface, does not of necessity involve the thoracic organs, but leaves its stamp solely on the mucous vestment? Where, at any rate, to take the most apparent indications, as tests even for untutored minds, where is the simple epithelial denudation of the mouth? where the characteristic redness and aphthæ of the vulva?

We insist, in the behalf of science, which sooner or later has modified, if not curbed, the fatal march of pestilence, that indistinct views and crude generalizations on this pest, or its theoretical pathology, should be banished at once from the field of observation; and that facts, indisputable in themselves and arranged

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according to the methods of scientific induction, should alone guide all future investigation as to the nature or treatment of this distemper. We should as soon now deem it wise, from the vague descriptions given by Homer or Plutarch of the cattle pestilence which prevailed in their days, or from the lines of Virgil in his Georgics,

> 'Concidit, et mixtum spumis vomit ore cruorem
> Extremosque ciet gemitus . . . . . .
> . . . . . at ima
> Solvuntur latera, atque oculos stupor urget inertes
> Ad terramque fluit devexo pondere cervix,"

or from any such meager materials, to theorize upon the pathology of the murrains which afflicted those ages, or their resemblance to or identity with those which have appeared in modern times; as from the occasional pustules, inflamed follicles, or the congested epithelium observed in rinderpest, to ally it with variola, typhoid fever, or scarlatina in the human subject.

But to proceed with the more positive share of our task. We have seen that the eruptions noticed on the flank and udder are papular (p. 289), not pustular, and that in a majority of cases they appear as indications of convalescence or resolution effected through the functions of the skin; so that it is quite impossible to trace any parallel between the Pest and the small pox, unless it be urged for the most fatal cases, where coma and death follow closely upon the first intimations of ailment, and the type of the former be sought in that most malignant form of the latter, known as *Variola sine eruptione.* All methods then, designed to ward off or mitigate an attack of the Pest by inoculation with variolous matter from the human subject, would, on grounds of similarity as to type between these diseases, and viewed theoretically, be condemned as empirical; a conclusion amply confirmed by many abortive trials to prove it otherwise. So too, we must treat as fanciful the opinion lately advanced that this epizoötic should be regarded as an acute internal scarlatina; the reddened appearance of the mucous surfaces, unaccompanied by the rash, as in the human subject, presenting the only common symptom. Yet we are happy to record the fact that no attempt has been made, either for prophylactic or curative ends, to transfer the poison of Scarlatina, into the veins of a Rinderpest subject.

Except in a few cases where vaccination may have introduced, in addition to the specific virus of the Pest, some typhoid germs, the inner surfaces of the viscera do not exhibit evidences of the degene-

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ration peculiar to typhoid fevers, or observable in the muco-enteritis of cattle; nor do the respiratory organs reveal serous effusion, as in typhoid pleuro-pneumonia. Dr. Tucker in his report to the Lord Lieutenant of Ireland, while repudiating any theory of identity, says: "The purple gum, the black, saltless blood, and some other symptoms of the *African* typhus, may be recognized in the Rinderpest." Why might not a parallel be drawn also with cholera, and influenza? The answer to this and the refutation of all the fanciful conceptions to which we have alluded, is given by science, which has very recently exploded the old classification of diseases, and has grouped those which we have mentioned, with many others,* in one leading class of zymotic diseases (order, miasmatic.)

The word *Zymotic* is derived from the Greek of *ferment* and was first suggested by Dr. Wm. Farr to indicate that diseases, so named, manifest in their course a destructive influence on the circulating medium, approaching as near as may be to fermentation, and due to the action of specific poisons of organic origin. These, like inorganic poisons introduced into the system, are found to obey certain general laws; first, that each has a specific action, and secondly lies latent in the system a certain though varying period of time, before its specific action is evinced; and thirdly, that the phenomena resulting from such action vary with the amount of poisonous matter taken into the system, and the receptivity of the patient.

The miasmatic order of this class, as applied to the diseases of cattle, may be understood to embrace all diseases which are commonly ascribed to *paludal or animal malaria*, all due to *specific disease poisons*, capable of propagation from one animal to another, and *communicable* either by *direct contact* or indirectly through various channels of intercourse.†

It is frankly admitted that this or any classification would be valueless in the investigation of the Rinderpest, unless it be conceded that this epizoötic is wholly distinct from others, and not only in its leading characteristics, but in its source or origin as a blood-poison. And it is principally in this latter sense, that we can pronounce it a disease "*sui generis*," developed through the agency of a poisonous germ, which breeds after its own type, and multi-

*Such as chicken-pox, measles, quinsy and diphtheria, croup and hooping cough, ague, remittent, continued and yellow fevers, ophthalmia, erysipelas, hospital gangrene and childbed fever, plague and carbuncle, dysentery and diarrhœa, &c.

† See Aitken's Science of Medicine, Vol. 1, p. 200.

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plies "after its own kind," and by a process as regular and uniform as that (to use the emphatic though homely language of John Simon, medical officer of the Privy Council in his sixth report) "by which dog breeds dog, and cat breeds cat, and as exclusive as that by which dog never breeds cat, nor cat dog."

The seminal principle or germ of Pest being considered then as *one* and distinct from that of other epizoötics, its varying manifestations remain to be accounted for. Its development as to time and potency is dependent upon certain spheric conditions, and the different susceptibility of races and individuals. Prof. Röll states that for many years the cattle plague hung upon the Polish frontier without entering Austria, until certain other diseases appeared among cattle and men, and then it became a general pestilence. As far as the historical records of other desolations among the lower orders of creation bear reliable testimony, this view is corroborated. It is also confirmed by the cyclical periods which, as is claimed, mark the devastation of this plague in its native steppes.

Again, it has been too frequently observed to admit of denial, that its fatality has been less marked with those cattle, of whom it may be said that the Pest is to the manor born, than among other races. Devons taken to Russia, after thriving admirably for a time, when brought within range of this distemper, yielded under its most frightful manifestations, and in droves.

So among the cattle first seen by Prof. Simonds in quarantine at Kamienica, a neighborhood which had then been free from the plague for eleven years, were four steppe oxen, three of which recovered, one having never sickened; while of the native cattle, with whom these and six other steppe oxen were housed at this and an adjoining village, in sheds belonging to the same proprietor; thirty-one, being the whole herd in one place, died within nineteen days after the steppe oxen arrived: and of the other lot, which included the four first mentioned, twenty-eight in all; thirteen died and eleven were slaughtered.*

The power of contagion being limited or increased by the operation of certain conditions in nature which it may be difficult to define, or by varying developments of constitutional vigor (which

* Perhaps a more marked case is given by Dr. Weber, as occurring at Kamionka Wolonka (Galicia), where 101 oxen, which were brought from Bessarabia, developed the contagion in the farmsteads in the village, so that 158 animals were attacked, of which 93 died; only *one* of the imported oxen suffered.

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may be equally vague in statement, though undeniable in fact) we are prepared to understand why in different climates and with different races of cattle, the symptoms and the morbid anatomy may seem doubtful or conflicting in particulars, and yet center in a common type, to mark the specific action of a specific virus.

Thus, where from any predisposing or dominant cause the force of the disease in its early incubation is expended on the membranes investing the brain (cerebellum, principally) or the spinal cord, we should expect the twitchings, nervous rigors and fury, and the consequent effusions in those regions observed in Hungary and Galicia by Egan and Simonds.

Where, again, as in the few cases referred to by Prof. Gamgee, the concentrated action of the poison is seen in the trachea and its bronchial branches, we could hardly imagine relief from this obstruction of the respiratory functions in time for any reaction on the intestinal canal. And where, lastly, the grand onslaught of the distemper was in the latter direction, we might reasonably look for lesions so much more distinctly pronounced, that what seemed only aphthous appearances in other cases might in these be imagined to be ulcerations; and glands which, in a vast majority of cases, seemed untouched, might give signs of purulent destruction. Making every reasonable allowance for different manifestations in cases such as those we have given from Jessen, where the disease was induced by inoculation; or for a predisposing tendency to the typhoid state, muco-enteritis, pleuro-pneumonia and the like; we are still able to group together all the seemingly conflicting indications, and define the general scope of this disease by its *congestion of the mucous tissues*, more or less diffused, and that congestion as mainly *destructive* of the epithelial covering of these tissues.

In the incubative stage, marked changes manifest themselves in the condition of the blood, and the commencement of feverish action. We have seen (p. 271), that when the virus has once been absorbed, it permeates within a few hours every portion of the blood, rendering each drop a fresh medium for inoculating the healthy animal with the Pest. It would almost seem credible, that the poison is a vital germ, feeding upon the germ cells of the blood, appropriating its serous and driving off its saline constituents; and propagating its kind until the red corpuscles become amorphous and shrivelled (see Pl. x, fig. 3). Gamgee, however, did not in his microscopic investigations, observe the serrated condition of the corpuscles noticed by Dr. Smart. In some cases he found "a great

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excess of white corpuscles, and in others delicate needle-shaped crystals, which are probably hæmato-crystalline,* form in the blood *after* this fluid has been drawn from the body."† (Pl. X, figs. 4, 5 and 6).

The moment that the normal balance in the blood constituents is disturbed, feverish action, which escapes notice by ordinary means of observation, is truly established. Gamgee reviving the use of the thermometer,‡ first proposed in 1754 by De Haen, a celebrated Clinical teacher in the Hospital of Vienna, as the best aid in the diagnosis of pyrexia; instituted a series of remarkable experiments in the use of one of Casella's registering thermometers. He discovered an elevation of temperature in the earliest stage of the disease, varying from one to four degrees, Fahr., "*preceding the acceleration of the pulse* and *every other symptom.*"

He inserted the bulb and about two inches of the stem of the thermometer within the vagina or rectum, and kept it in place a couple of minutes. To prevent error in the use of the instrument, he adopted the precaution, between each observation, of dipping it in water (90° Fahr.) and used a few drops of Candy's disinfecting fluid for cleansing purposes. He found the temperature of these parts, when the animals were in a healthy condition, and the females not in the period of œstrum or sextual excitement, varying from 100° to 101°, rising occasionally to 102°, and perchance, in a hot day or when driven from their pastures, "one or two-tenths more" than usual. He visited on the 17th of November, a stock of Ayrshires, at Corehouse, near Lanark, where a cow, seized on the 9th, had died on the 14th, a second case occurred on the 15th, a third on the 16th; and where, on cursory examination, he found six more ill. On the 18th he examined forty-two cows with a thermometer dipped in water 100° Fahr., before each observation, inserting the instrument in the rectum up to that portion of the

* These crystals may be regarded as evidence mostly of the decomposition which the blood undergoes, and of abnormal chemical combinations of its saline constituents. They resemble closely in form and appearance those recently obtained by Wormley in the methods proposed by him for the discovery of poisons when found in human tissues in minute quantities. For these correspondences, see his "Micro-chemistry of Poisons, Pl. I, figs. 1, 2 and 3," where the forms of crystalline products are given, as revealed by the microscope magnifying, from 80 to 225 diameters; the 1-250 gr. of chloride of potash having been tested by a minute trace of tart. soda; 1-100 gr. potash as nitrate, treated with bichloride of platinum in one case, and tartaric acid in the other, and in Pl. IV, fig. 4, where the crystals of tart-emet. from a hot super-saturated solution without any re-agent, are magnified 80 times; and in other plates for the needle-pointed crystals.

† See Cattle Plague, page 64.

‡ Also tried by Dr. Sanderson (Sequel, &c, p, 13.)

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stem marked 80°. Of this entire lot, one or two had slight discharge from the eyes; one gave more marked indications in rapid respiration, one in urine of dark brown color, and a half dozen in scanty supply of milk. The rest were eating and ruminating, giving full qnantity of milk, &c,; none had diarrhœa. "The temperature was recorded at 102° in one case; at 104°, 1– in another; at 104°, 8– in two; from 105° to 106° in ten; from 106° to 107° in seventeen; in the rest from 107° to 107°, 8–. Twenty-five succumbed by the 22d inst., and only five were living on the 25th, "in spite of careful nursing and the best medical treatment." Gamgee observed variations in the frequency of the pulse and temperature during the course of the disease, as Jessen did between the pulse and respiration; also a sudden lowering of temperature with increased frequency of pulse from 120 upwards, a few hours before death. A *gradual* decrease of temperature until it reaches the normal standard prognosticates recovery.*

It seems a matter of regret that Dr. Gamgee, who has evinced in all his researches, skill and learning of the highest order, should have felt such utter hopelessness of the efficacy of remedial treatment *in posse* if not *in esse*. Otherwise we think he might have gained another laurel to his veterinary prowess. Nothing seems to be clearer than this proposition, that if the pest is to be properly regarded as a zymotic disease whether developing its fatal germs in the blood, on and in which they feed and multiply; or by an action analogous to ferment, or that chemico-physiological action which Liebig has denominated catalysis, producing abnormal changes in the circulating medium; before the disintegration of structures (the principal test of infection in disease) is manifested: or to take a more palpable illustration, to be viewed as poison from a venomous bite, which must be instantly neutralized, or whose absorption and propagation must be arrested without loss of time that life may be saved; the treatment must be antidotal or destructive of the foreign germ-life, and attempted before the processes of decomposition in the blood have gained much headway. And to this end the use of the thermometer as afresh proposed by Gamgee is indispensable. But it is unnecessary further to foreshadow the use to which we propose to put this method in the treatment we may recommend.

The microscopic researches of Dr. Brauell, of Dorpat, made in

*Cattle Plague, pp. 40–44.

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Southern Russia in 1861, extend, in some respects the pathological views to be derived from the investigation of lesions heretofore given on the authority of Smart and others. He observed in the glands of the mouth and pharynx, new formations of cells simultaneously with (probably before) the detachment of the epithelium, and a more exuberant mass of such cells in the glands of the fourth stomach, and small intestines, followed by the hæmorrhagic erosions, or so-called superficial ulcers. In the solitary glands of the small intestines, in a less marked form than in the Peyer glands, the cell development goes on, attended by the "so-called plastic exudations and croupous deposits from the follicles, the vesicular eruptions and the ulcers" of the glands described by authors; all owing their origin to the nature of the cell changes. In the mucous glands of the membrane lining the respiratory passages, there is cell multiplication, associated with the extraordinary development of the elements of connective tissue, whereby the detached masses are accounted for. The *separation* of these is the *end of the process.*

Brauell affirms that there are *never* and *nowhere exudations of lymph.* He also notices differential manifestations as between the natural Rinderpest and that from inoculation.

"The nodules which appear on the skin owe their origin to the modified development of the epidermic cells on small localized spots, from which the deeper sooner or later become detached and result in the dispersion of the nodules. The most superficial layer of the skin, wherever it is covered by each nodule, sometimes suffers molecular change."

Perhaps the most important observation made by him in inoculated cases, is that, in the lateral ventricles of the brain, and particularly under the arachnoid over the cerebrum, exudation is met with.*

It may not be easy of comprehension how the imbibition of the virus through the organs of the skin, should produce such marked cerebral disturbances, not consequent upon its inhalation by the lungs, or its absorption by the mucous surfaces of the mouth, nose, &c. When this statement of Dr. Brauell is connected with the general testimony of all observers, that in a multitude of cases where the pest has been induced by the seton or puncture, the lesions are more extensive and serious; it may lead us, as a teaching of practical

* Et ubi supra. (Cattle Plague, pp. 66–69.)

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sagacity, not only to avoid inoculation as a method of cure, and to guard the entire dermic structure of subjects exposed to contagion by cleansing and care; but in some measure, at least, to adapt their treatment, when ill, to the consideration, however conjectural it may seem, that the secernent function of the skin is the most important instrumentality by which the poison may be counteracted or eliminated.

Lest we may seem to speak slightly of the inoculative method, which we cannot recommend as a therapeutic or preventive agent, we will add a brief sketch of the efforts made to test it as an agency of cure. The seeming success which resulted from inoculation for small-pox in the human subject, led to great hopes of the efficiency of a similar use of the poison of the distempers of the last century. England, which was prompt through Dobson, in 1754, and Dr. Flemynge, in 1755, publicly to approve the method, exhibited the same decision in proclaiming it a failure. The first tabulated series of experiments, were made under the direction of the famous Camper, on a small island on the southwest of Zeeland, of which accounts are preserved for three years prior to 1773. In 1770, sixty-one animals were inoculated, by threads charged with the virus and passed beneath the skin, of which eighteen recovered and forty-two died; one not having sickened. Of those treated in the next two years, a fraction of over one-third did not catch the contagion, and the number of deaths reported was three.

Gamgee, in his review of this subject, deems the experiments of 1770 most reliable, as he found in the accounts for the two succeeding years, records* "of long periods of incubation, and constant recovery, quite incompatible with our existing knowledge of the disease."

The success of Dr. Barrasch, who inoculated twenty-five hundred cattle in Hungary, of which only seventy-five died, and the serious losses of Russia, amounting, as was estimated, to ten millions of roubles annually, led to the appointment of a commission with the view of extirpating the pest among the steppe oxen and on their native pastures. Jessen and Unterberger conducted the experiments, which were first tried with the virus taken from a subject who had taken the pest naturally; then from one so inoculated, making the first remove, and so on until they obtained and used the virus in the tenth remove. With great alternations of large

* These may be regarded as additional evidence that the distemper of that period was not the Rinderpest.

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percentages of recoveries and failures; with instances of immunity in the midst of surrounding pestilence, which inoculation, wherever tried, had not stayed or much ameliorated; with a tabulated record, though on a small scale of fifty per cent. loss with matter in the first and ninth remove, sixty-six and two-thirds per cent. with that in the third remove, and no loss whatever with that of the second, fourth, fifth, sixth, seventh, eighth and tenth: it is difficult to discover any method for the arrangement of such statistics and the evolvment of any scientific formula.

The impression that steppe cattle might be advantageously fortified in this way, was modified by the observation that inoculation must be accompanied by mild and uniform weather, and followed up by careful nursing.

The recent trial on steppe animals at Karlowka, in 1864, in which of three hundred and forty-nine inoculated animals, the sickness consequent upon the operation was so remarkably intense, that only ten were declared to be "not severely affected," accompanied by the fact that there are in the steppe regions of Southern Russia herds among which the pest has not prevailed in ten, twenty, and in one case forty years, give great force to the practical question put by Prof. Unterberger, whether such experiences do not prove how *disadvantageous* under certain circumstances *protective inoculation* may be even in the steppe regions.

Jessen, whose loss in the treatment by inoculation of the stock of the Grand Duchess Helena Paulowna, has been reported at ninety per cent., does not pronounce so decidedly against the method as his colleague, although he admits great losses by inoculation with fresh matter. He sums up his report with the following conclusions:

1. Animals having had the Rinderpest three to four years previously, cannot be affected again.

2–3. Vaccination in the first generation (taken from diseased animals), on sound cattle, after they have passed through the disease, frees them from further infection.

4. The loss by first generation is too large to recommend itself.

5. The vaccine can be mitigated by second generation, producing only a slight affection.

6. This slight affection is also a preservative against new infection.

7. Vaccination in older animals often fails, probably because they have had it.

8. Vaccination sometimes does not take, and yet they take the plague naturally afterwards.

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9. Some cattle show no symptoms of disease after vaccination, and yet they seem to be proof against infection.

10. Well preserved vaccine keeps good for a few days, even in hot summer.

11. It is yet to be discovered on which day of the disease to take the virus, to get its full power.

12. The tears, even diluted with distilled water, remain infectious (these and the nasal mucus having been used for vaccination).

To these may be added other conclusions arrived at by Gamgee, who obtained 40 per cent. of recoveries in experiments by inoculation in seventy-five cases, and who, besides refusing to recommend this method as a preventive; noticing the aggravations resulting from cold, wet and exposure; declaring the means adopted for cultivating or modifying the virus unsatisfactory and unreliable; and any liquid from the body of a sick animal capable of becoming a medium for inoculation, adds:

1. The cutaneous eruption not constant in natural Rinderpest is usually seen in inoculated animals.

2. Sheep can be inoculated from cattle, and again cattle from sheep, without modifying the virulence of the virus.

3. Glycerine modifies and then destroys the virus, as in the case of pleuro-pneumonia (typhoid?)

4. Animals escaping after inoculation, without indicating the characteristic symptoms, are not protected from future attacks.

5. The produce from progeny of animals which have had the Rinderpest, is as susceptible to an attack as any other.*

The science of Pathology which has made such mighty strides during the last half century, has yet to search out the nature and perchance figure the form of those poisonous germs which develop zymotic disease; to give them distinctiveness by due classification, and to separate or identify their action on, and power over the animal economy, with those of the well known poisons of the *mineral* or *vegetable* world, especially, perhaps, of the sporules of the various tribes of fungi. The work, though vast, is not beyond present hope. It has now all the preparation needed to justify the loftiest claim, and maintain the highest attitude of expectancy. The microscope, which has depictured and classified the various forms of spermatozoids constituting the generative power of the divers species of the animal kingdom; which has counted the number

* Cattle Plague, pp. 198 and 199.

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of the dust sporules* which feed upon vegetable products useful to man and beast, and which, as we have seen, reveals to the eye the various shapes of blood corpuscles when invaded by various parasites of variant diseases, may yet so group its subtle lenses and direct their ken into such unexplored hiding places, and triumphantly parade the tiniest instruments of torture which the common enemy of all things living employs.† While we await with becoming patience, such wondrous revelations, we are not without the analogies of nature in disease to assist and advance our investigations.

Dr. Salisbury, of Ohio, in the presence of an alarming epidemic of scarlatina, inoculated himself and family with the smut of the Indian corn, produced an eruption and fever similar to that of the prevailing distemper, and effectually warded off the contagion. Had he gone a step further, and ingrafted the poisonous fluid developed by this coniomycete upon a healthy structure, he would have identified or shown the disparate action of the inoculate and natural forms of the scarlet infection. We know that a pregnant heifer may, by ergotized grain, or grasses infested with fungoid growth, suddenly abort, and unless removed from her associates of the byre, the poisonous exudations from the vulva will produce like disaster upon the entire pregnant stable; leaving in the future for all such aborting from the contagious matter, less chance of carrying their next fœtal burdens to full development, than in the case of the one which miscarried under the action of the vegetable poison. So that there may be in nature a general law by which certain poisons, vegetable as well as mineral, may become potentized in their victims, and taking to themselves a more deadly virus, spread the most virulent infection. Strange as the announcement of such a doctrine, mysterious as the conversion or coöperation of such agencies may be, they do not afford so great a puzzle to the understanding, as that by which we are called upon to account for the first developed case of any contagion, whether of small pox or cholera in the human race, or of any of the deadly murrains in the bovine.

*The sporule of the Uredo segetum, one of the most minute of the coniomycetous fungi which attack gramineous plants, has been decyphered as equal in size to 1-7,860,000th part of an *inch square*.

†The most serious difficulty in the present extension of microscopic vision, which has revealed the multiplication of bacteria and low animal and vegetable organisms by powers estimated at 3,000 diameters, does not seem to lie in a further extension of micrometric power, but in the *transparency* of these infinitesimal germs; a difficulty which may soon be remedied by the ingenious adaptations of enthusiastic observers.

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We state the difficulty which is experienced in the scientific world, without insisting upon any theory, conjectural or imaginary. It is enough to dispel existing delusions which trace the sources of contagion solely to malarious vapors or atmospherical degenerations, or again, to active animal or vegetable parasites, or to any other source than that of poisonous vitalized germs.

It is impossible to deny the vitality of pus corpuscles in ophthalmia, in the public nurseries or hospital provided for children; or of their minute offsets (revealed with wondrous power of subdivision under the microscope), as they are transported through the air, remain dormant on clothes, communicated by towels, until they reach the conjunctiva, prepared in under-tone or by morbid process, for the supply of nutrient matter for these putrid germs. The statistics of surgical cases in our armies during the late war confirm the observations made elsewhere, that pus globules invade the system of one recovering from the primary effects of wounds or amputation, and carry him off with pyæmia.

Like observations as to syphilitic or gonorrhœal pus, the poisonous matter of puerperal fever, or the more familiar illustration of vaccine lymph, give confirmation suited to the general mind of the theoretic views we have advanced, and which are so thoroughly supported by the researches of Prof. Boeck.

But the nature of this exotic germ-life which, when introduced into the vital economy, is the harbinger of pestilence, is not to be explained by (as the morbid germs themselves are not to be confounded with) the animalculæ observed in the dying organism. The bacteria which have been revealed by the microscope, prove only the previous destruction of tissue and its *advanced* state of decomposition; such relation being reversed, however, in the case of parasitical growths.

Should we pass over, although not precisely relevant in this connection, another condition, under which this morbid germ-life may be sustained, we should be guilty of a neglect which might result in great practical injury.

It may not be easy to prove that the germ cells of the pest or other infectious disease can multiply in excrementitious matter as in the living body. But it would be unsafe to consider the exuviæ when kept moist and of a moderate degree of heat,* as incapable

* Prof. Hertwig stated at the First International Veterinary Congress, a case where dung of diseased animals, even after it had lain in a *frozen* state for four weeks, was known to have transmitted infection. (Gamgee's Cattle Plague, p. 479.) Even the water in

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of furnishing the media for such propagation, unless we had reason to conclude that the matters thrown off by the bowels or otherwise, contained none of the nutrient matter, on which these germs of pestilence might feed, or the enveloping substances in which they might lie dormant and be preserved. For all practical purposes, and as the first law of hygiene applicable to such cases, all matters thrown off from the organism that is contending with the pest, should be regarded as a fresh nidus of infection; unless thoroughly disinfected by chlorine, carbolic or sulphurous acids or the like.

Here it may be desirable to insist upon the necessity of a very careful diagnosis. This should be made at the earliest possible opportunity of observation, and then with all the precision which scientific research demands. We have already observed the great importance of thermometric observations as testing the commencement of feverish action at a time anterior to its sensible perception by ordinary methods. Where the means of applying this test are not afforded, it will be proper to observe the condition of the papillæ of the buccal cavity (and where easily done of the Schneiderian membrane) before epithelial desquamation has taken place. These will show to the eye (more thoroughly if aided with an ordinary lens), enlargement if not engorgement, in the uprising of small round nodules (seldom according to Jessen larger than a millet seed), with marked redness beginning at the apex. The papillæ are still covered with epithelium, beneath which, after a little while, a yellowish or yellowish gray fluid can be seen. Within twenty-four hours, the investing membrane breaks away, and if the neighboring papillæ are not then affected, the minute orifice may soon be hidden and heal; but if they are, their cicatrices become confluent, the epithelium is rolled off in masses, the scarlet redness of the subjacent mucous membrane is quite apparent, with irregular marginal outline. As others in a widening circle become affected, redden, and desquamate towards the outer rim, the central portion thus run over, loses its ruby tinge, and gradually assumes an aphthous or gray appearance, mistaken by the ignorant for an ulcer.

The philosophy of this action in these minute nodules can only be fully revealed through microscopic teachings, which show that each papilla and the villi (fringe-like hairs which emanate from it

which Rinderpest flesh (whether previously salted or not) has been washed, if drank by cattle otherwise untainted, will produce an outbreak; as will the hawking about of the flesh. (Ib., p. 36.)

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and give to all mucous membranes, more especially in the smaller bowels, a velvety appearance), are furnished with a complete vascular plexus (arterial mainly in the villi*); and that through such exceedingly delicate net-work the diseased blood corpuscles are borne, and are thus enabled to expend their peculiarly destructive action upon the speck-like expanse of epithelium which invests the external surface of this miniature circulation.

Whether these processes of congestion and desquamation in the pest are precisely the same in epizoötic aphtha or eczema, is not probable, if analogy be sought with the observed action of the latter disease in the fourth stomach, (see p. 290,) where hæmorrhagic or apoplectic effusion and erosion, sometimes attended or followed by melanotic deposits, seem to take the place of the simpler lesions which result from pure capillary congestion in the former malady. No careful inquisition has, as far as we can learn, been as yet instituted to demonstrate or disprove in the membranes lining the mouth and pharynx, the difference of action just indicated.

The appearance to the eye of these lesions in the mouth and the common phenomena of smacking the lips, of aphthous eruption and salivary discharge, are said to be the same in both affections; and to distinguish between the two, resort is had in order to identify the eczema, to the morbid condition of the cleft of the lame foot, the papulæ on the teats and the symptoms of congestion and inflammation of the udder.†

The unwary might also easily be deceived by the redness of the vagina which exists in the case of those that have recently calved, or aborted after long gestation, or who have arrived at the period of sexual excitement; if looking only at the arterial color of the parts to which the unusual flow of bood is directed in these processes of nature, they should imagine a general papillary congestion to have taken place, not to be resolved and fade away without epithelial disorganization.

Nay, it is further said, that in those who are ruminating in pastures and daily yielding a full flow of milk, a like rubescent demonstration not unfrequently takes place, so that the mere indications of color may be fallacious. Unless then the sanguineous tinge of the vulva be seen on the near approach or in immediate presence of the Epizoötic Pest, it would be no sure sign. If the eye, unaided, could not detect engorged or discharging papillæ, a

* See Quain's Anatomy. † Gamgee's Cattle Plague, p. 56.

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lens should be brought into requisition, before the true pathological sign should be anticipated, the destruction and peeling off of the epithelium.

We will briefly notice other sources of illusion. The discharge from the eyes and nose occurs in many affections, fatal or transient; but in the pest, it soon becomes glairy and changes to what is termed a turbid secretion. Yet it would be absurd, in view of the pathology of the murrains of the last century we have so fully detailed; to confound this discharge with the purulent one, resulting from a phlegmonic or ulcerous condition of the system; neither should the prediction be too easily made, that the initial watery flow, however copious, would readily be changed to one of more significant consistence or color. Gamgee gives an apt illustration* of this, from cases occurring at his establishment in Edinburgh, during a series of inoculation experiments, conducted by a commission of the French Government. Great care was exercised in the purchase of animals free from the distemper, in order that such experiments might be wholly reliable.

Three animals were purchased one day, receiving the guaranty of the seller as being free from any contamination with the prevailing epidemic. They had each, however, the glairy discharge from eyes and nose, but did not develop any further evidences of ailment. It appeared, on inquiry, that they had been exposed to easterly winds in an ill-sheltered field, and the discharge was only diagnostic of a *slight catarrh.*

Greater complication arises mainly from discrepant authorities, perchance from inherent causes, as to proper diagnostic position of the lung and skin symptoms.

Smart affirms that "there is no cough or lung symptoms in the pure and uncomplicated examples of the disease," but limits the respiratory changes to a prolonged *outbreath* (p. 273). Egan, Gooch and Gamgee notice a short, dry or husky cough, with difficulty in breathing (Gooch), attended by more noise in expiration than in pleuro-pneumonia (p. 274). These may, at the commencement of the attack, be regarded as merely nervous demonstrations pointing to cerebellar or spinal irritation. But if they do not shortly subside, if with the cough the head is kept depressed and protruded, and a spasmodic action of the nostrils and flanks sets in, serious pulmonary paralytic action, if not lesion, must be apprehended. Gamgee, combatting the observations and authority of Smart, insists that

* Gamgee's Cattle Plague, p. 49.

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emphysema occurred in many cases under his eye, usually beginning in the anterior lobes; the *modus operandi* of the peculiar respiration induced being explained by Dr. Weber, who says that the anterior intercostal spaces become somewhat fixed, while the posterior true ribs are raised with an effort and sink rapidly.* The signs which attend this forceful outbreath on percussion have been given (p.290 and note). Auscultation reveals râles of various pitches, either accompanying the vesicular murmur or superseding it. The sounds of the heart are inaudible and impulse imperceptible on the left side.* But these furnish indications of a fatal resolution, and are not to be regarded as among the earlier symptoms.

The cutaneous eruption which frequently occurs on the neck, back and teats, justifies a favorable prognosis, if occurring in the earlier stages; but if, instead of drying up and scaling off, the papules remain or multiply, and the color of the skin becomes a dirty yellow, desquamation of the epidermis becoming general, and the surface of the neck and of the integuments extending over the crops becomes greasy from a sebaceous secretion (see p.289 and note, &c.), then coma and death may be speedily anticipated. In the first issue the relief that is afforded to the perspiratory energies, without serious impairment of subcuticular structures, is communicated to the nervous centres, and a rallying of the sustaining power is soon manifest. But if, as in the second issue, the destruction of the epithelial cells of the skin proceeds far enough to involve to any great extent the nervous periphery; the ganglia, cord and brain labor with the barest possibility of recuperation of energy.

It is in view of the preservation of this balance of nervous power in struggling nature, or, if more precisely phrased, of the salient energies of the filamentous nervous expanse reticulating about every gland and perspiratory orifice of the skin; that we may find a clue to the mystery in which we were content for the time being to remain, when we did not essay in a previous connection (see p. 314) to explain the cerebral disturbances, produced by the borrowing of the inoculative virus throughout the epidermic cells and their mucous substrata. Nor can we find time to dwell upon this problem in physiology, or deduce any corollary, except as presage of the practical use to which we may apply it in the treatment recommended.

The nature of these eruptions on the skin we have seen not to be vesicular. Wherever they have appeared to be partly umbilical,

* Gamgee's Cattle Plague, p. 49.

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the pest is complicated with ordinary cow pox; Gamgee giving the assurance that he had never seen an eruption of this description where the previous existence of the vaccine pustule could be doubted. Moreover, this eruption is not to be mistaken for the maculæ or petechiæ which are met with in typhus of the human subject; the former of which are slightly elevated spots of a dusky pinkish red color, somewhat like the stains of mulberry juice, fading under pressure, but changing sometimes to the nature of the latter, which are of a dusky crimson or purple color, numerous and closely compacted, unaffected by pressure. Neither these eruptions, the appearance of the tongue, the pyrexic period, the general absence of capillary congestion in the bowels, the red serosity found in almost every serous cavity, the deep dusky red hue of every structure in contact with the blood, in which the salts are increased instead of being diminished; the absence of bile acids and the presence of tyrosine and leucine (p. 288); nor the abscence of exhausting diarrhœa; the deep inspiration followed by short respirations in rapid succession; the wasting of the involuntary muscles; the softening of the heart and the atrophy of the brain which occur in typhus, furnish any common basis from which we may view the pest as its counterpart; nor for the justification of the synonym given to it on the Continent, "Typhus boum contagiosus," or "Le typhus contagieux des betes bovines" of the French school.

Time will not permit us to notice all those marked symptoms and lesions of typhoid fever (in themselves very numerous and variable) which are not to be found in the vast majority of cases in the pest. We may briefly specify the greater redness observed on the surface of the mucous membrane in the latter disease (compare the capillary congestion of the small bowels, P. IV. fig. I) or the engorged spaces between the rugæ of the cæcum (Pl. VIII fig I), with Pls. CXII, CXIII, CXIV, of Lebert,* where the mucous surfaces of the smaller bowels do not show congestion beyond erythema; this faint rosy or pinkish redness being a characteristic of typhoid exanthemata in the smaller bowels, as confirmed by the previous exposition of Cruveilhier (Liv. 7 Pls. 1–3). This congestion quite limited to the ileum; the deepening erythema investing the solitary glands leaving the adjacent tissue almost anæmic; the ulceration of these glands, as also of those clustered in groups, (Peyer's patches or plates) starting from within the mucous bed and inducing frequently gangrene, not only opening out upon the inner surface, but perfor-

*Traite Anatomie Pathologique, Gen. et spec . . . . par H. Lebert. Paris, 1855-61.

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ating sometimes the peritoneal coat; the invariable enlargement of the mesenteric glands and of the spleen; together with infiltration and consequent solidification of the lungs, previously adverted to, (p. 290) make a more marked departure from the type of the pest in typhoid than in typhus fever. Yet, however, it must be constantly borne in mind that vital depression, which is the leading characteristic of what is commonly called the typhoid state in disease, is manifest in the pest from the first stages until convalescence is established.

The exanthematous process which shows itself, as we have seen in the agminated and solitary glands, producing slight rubescence, then injection, tumidity and enlargement, ordinates the general progress of what is commonly described as follicular growth. When the enlargement has reached its acme two variations occur; in diminished or suppressed secretions from the glands or follicles, or in its becoming more abundant; in which last case are manifested alternative methods of disposing of the fluid secreted; in its either being poured out in the membrane very freely, or in being retained in the cavity of the follicle, becoming inspissated and undergoing various other secondary changes.* The progressive stages of exanthematous action thus defined, give enabling facility to explain the seemingly discrepant statements given by different observers as to the manifestations of the pest on the intestinal canal; in the apparently opposite show of diarrhœic discharges, unmixed with mucous, as in the majority of cases (see p. 275, &c.,) observed by Egen and others; in more acute cases tinged with blood, becoming dysenteric in appearance, &c.; in others partaking of the character of rice water stools, and, as in the vaccinated cases, leaving traces of purulent destruction. Yet we are not, by reason of such occasional manifestations, to misapprehend the general nature of this pest for muco-enteritis or dysentery, as the principal seat of such lesions is in the tubular glands (follicles of Lieberkühn) of the large intestines.

The occasional occurrence of rice-water stools intimates that in the acutest form of the catarrhal inflammation of the mucous coat of the intestinal canal, we have some approach to the rapid and fatal exhaustion of cholera; this leads us to dwell briefly upon the lesions of the latter disease, which bear not only to the ordinary observer, but to the skillful eye of the pathological anatomist, some very singular resemblances. During the period of transudation. we find the same separation of the water and salts of the intercel-

* Rokitanskyt Patholog. Anat., Vol. III, p. 56.

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lular fluid of the blood through the mucous membrane of the intestinal canal, resulting in the same colliquative discharges per anum, and the inspissation of the blood itself, which becomes dark and tarry (p. 288). The hypertrophied muscles, after death, show on section the same dark purple red color, with a shade of blue or violet (p. 289), although, according to Rókitansky, this peculiar iridescence is shown in other affections.†

We notice in the pest less marked absence of external heat, comparatively little tendency to the suspension of the decarbonizing function of the lung-cells; and while in the intestinal canal the follicular structure is equally involved in both maladies, though in a different manner, and except in the rare cases seen in Pest, with discharges of a totally different character; the congestive process in its earlier stages suggests its rationale as well as that of these variations.

We need not reiterate that we do not seek to build up any theory of identity or analogy except that which is necessitated by the common zymotic character which pervades all pestilences. Having given the few points in which their orbital paths find conjunction, we still desire as far as practicable within the narrow compass of a general report to project the direction of their courses in departure. We shall collate two descriptions of such variations from Perigoff, whose recondite observations on cholera accompanied by remarkable illustrations of lesions (also of microscopic researches) are to be found in his Anatomie Pathologique, &c. Premising that in the congestive stages of this disease, we are met with deeper blood-tinting than in any of the affections of the human frame, we have before referred to, we find it necessary to show other manifestations in these stages in the two diseases, between which it is now proposed to mark the difference. Perigoff gives in Pl. II, fig. 3, (in a case of death in typhoid stage), the sanguineous coloring of membrane less deeply tinged than others given by him, which on cursory, examination would seem to be identical with that described by Smart (p. 282 and Pl. III). Sanguineous effusion upon the mucous membrane in dots occurs also in simple cholera; and when multiplied in an aggravated case presents an appearance of dark ecchymosis, bordering upon what is elsewhere described by Perigoff, as the incipient stage of mortification. His Pl. V, A, fig. 3, gives a view of the sigmoid flexure of the colon in the transition from the algid to the typhoid stage which bears a closer resemblance to the

†Typhus, acute convulsions, scurvy, cyanosis, and in persons suffocated. Vol. III. p. 304.

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inoculated cases in Pls. VI and VII (pp. 277 and 279). You can easily see in all of Smart's drawings that the scarlet tinge we are noticing is the result only of the congestion of the minute and intricate network of the capillaries, the attendant sign of this vascularity being always present; while in these plates of Perigoff, this gorging of the arterial plexus is not apparent, the blood seems rather to be effused, its particles impaired and aggregating by some molecular attraction (not of course as in the normal adhesion of the rouleaux); in short, in the first plate referred to, a bright red, in the second the deep crimson tinge quite approximating to a dark red ecchymosis. The mucous membrane in both plagues is peeled off or abraded; but in the choleraic cases, by a different process, and by a movement starting at a deeper point in the mucous tissue that in most cases of the Pest, being covered with mucosity as well as with detached epithelium; and when these are removed, presenting not simply the spots of membrane run over by vascular engorgement and left seemingly aphthous; but depressed eschars in the surrounding membrane which is puffed up and anæmic.*

When we follow Perigoff to his Microscopic Researches in cholera, we find his tracings of engorgement of the solitary glands and Peyer's plates, and their transformations; of capillary congestion of the villi (villosities of the continental schools), as well as the deeper burrowings in the mucous coat; confirming to a large extent the observations previously made, and giving the starting point, of congestion, infiltration and exudation in most if not all zymotics. We must refer the curious in such details to the subjoined trans-

* For confirmation of these and more singular indications and processes of abnormal action and illustrations of its rationale, see pl. V, A, fig. 1, where Brunner's glands deeply inflamed, surrounded by injection are ready to ulcerate, summits yellow and containing pus; the membrane (duodenum) swollen and presenting traces of dysenteric exudation; also fig. 2 in same plate, where the mucous membrane completely hyperæmical, is covered by thick adherent greenish yellow effusion, composed of the debris of plastic globules, epithelial cells, &c. Pl. VIII gives section of the colon of one who had suffered from chronic diarrhœa when cholera supervened, and shows the aphthous appearance resulting from the former affection, with hyperæmia and sanguineous effusion in the intervening spaces from the latter. Ulcerations of Peyer's plates were seen but three times and then in the cholero-typhoide period. Comp. pl. IX, figs. 5 & 6. Pl. XII gives section of stomach in diptheritic cholera, the mucous membrane being hyperæmic, and covered in places by patches of *adherent* gray exudation, these surrounded by a gray areola; when the patches are scraped off, the subjacent membrane very hyperæmical. (Comp. pl. VI, fig. 2.) In the case where the stomach was covered more or less with mushrooms (eaten in Lent by a Russian), the membrane showed a swollen appearance, being described as in "un état catarrhal aigu"—hyperæmic with punctated injection.

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lation* of the text expository of these minute portraitures. The deficiency of its proper salts in Rinderpest blood has been previously noticed (p. 288). In the inquiries prosecuted by Dr. A. Gamgee to ascertain the changes which this and other fluids underwent in the earlier and progressive stages of the disease; no attempt was made to ascertain the percentage which the salts bore to either.

***Pathological alterations of the mucous membrane of intestines, enlarged 50 to 400 times, as given by Perigoff in explanation of his Plate XVI.**

Fig. 1. Peyer's plates (glands) of ileum, tumefied by simple choleraic processes, enlarged eight times; *mucous membrane detached, muscular covering naked.* Plate of Peyer looked like a bunch of grapes, composed of semi-transparent vesicles reposing upon the mucous membrane, and covered by villosities. When magnified, the epithelial cells, their nuclei and globules, resembling somewhat the microscopic *elements of* recent *plastic exudations.*

Figs. 6–9. Isolated follicles of mucous membrane represented under aspect of vesicles, a *little swelled,* as in chronic maladies of mucous membrane, and surrounded by a *bloody areola.*

Fig. 7. Shows enlarged by microscope nearly 30 times, little fly-spots (mouchetures), round and blackened; met on mucous membrane, near the isolated crypts in the typhoid stage of cholera and chronic diarhœa shown under the form of an areola, composed of the vessels of the sub-mucous coat at circumference and center of areola, sometimes numerous blackened points or fly-spots being, the ruins of bloody globules escaped from the vessels and dispersed in the mucous tissue. Sulphate of iron enters into their composition, as is proved by its solubility in hydro-chloric acid. The contents of these crypts resemble epithelial cells, and their nuclei; more than pyoid and plastic globules.

Fig. 8. Isolated follicles, tumefied, enlarged 10 times and covered with villosities, which are swelled and engorged with blood.

Figs. 10, 11. Superficial layer of eschars in large intestines; brown appearance depends upon agglomeration by matters of decomposed bloody globules, under aspect of brown spots, (containing sulph. iron) sometimes *deep purple. Numerous crystals* on surface of scars are the double salts of ammoniated phosphate of magnesium. Same microscopic elements seen in dysenteric exudations accompanying cholera.

Figs. 13-21. Villosities of mucous membrane, covered with cylindrical epithelium, seen sometimes in the algid (cold) period, dissolved in choleraic liquid macerated and swollen; and epithelial envelope detached and exfoliated. A light touch detaches it completely: under the microscope looks like the down of the dandelion. The denuded villosities show sometimes a strong hyperæmic state, the vascular net-work is completely injected; or, in places, sometimes an anæmic state; the empty vessels showing across the pulp of the villosities, covered again in some places by nuclei of detached epithelium—the black fly-spot and globules of blood decomposed and coming out of vessels on the pulp of the villosities; and the principal coloring that of bile. Sometimes, in fine, the *tissue* of the villosities despoiled of the epithelium, is *softened macerated;* their extremities are ragged, flocculent, ulcerated and mortified. The puffing up of the villosities, the hyperæmia, and tendency of the epithelium to detach itself after the *maceration* in the *choleraic emulsion* are principally observed in the algid period. It seems that the cellules of the epithelium were themselves altered. They appeared more swollen, more gorged with liquid, and fuller of fatty globules, than in the normal state.

At the same time the mucous coat of the intestines is pale and anæmic, the sub-serous vascular net-work is incompletely injected, and even when the vascular net-work of the villosities shows itself to the microscope, empty in whole or in part, the contour of these vessels remains incomparably more distinct than in the normal state. One sees that the net-work was but lately filled with blood, and that it had been in a hyperæmic state.

I have often observed, with the microscope, bloody globules in the vascular net-work of the villosities agglomerated, adhering strongly to the coats, having an angular form,

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except in the case of the milk.* The analysis of the urine† in some cases showed the chlorides to be abundant; in others, where inflammation (pneumonic especially) was extensive, deficient; but these were never quantitatively determined. It is to be regretted that the same elaborate examination has not been essayed to ascertain the loss of the several saline constituents of the blood, and the order in which they take their departure from the serum as well as from the blood corpuscles in cases of the Pest, as has been

stellated, color deep purple, yellow-brown or black-brown. As to the villosities deprived of epithelium, covered with little points of a yellowish or dark brown, softened and ulcerated, they have been observed principally during the *typhoid* period, and in the mixed kind of choleraic processes.

Finally, in typhoid and choleric dysenteric forms, I have often seen the mucous membrane, especially in the ileum, stripped of its villosities for a considerable extent.

The exfoliation of the cylindrical epithelium, and the denudation of the villosities, are not to be considered as pathological indications essential and characteristic of cholera. 1st. Because found in chronic diarrhœa, in typhus and dysentery, and other affections of the digestive canal. 2d. Not always found, in the algid period, at least, in such degree as to be regarded as the *principal* alteration of the mucous membrane of the intestines; and, 3d. When the exfoliation of the epithelium by the choleraic process has taken place, even to a considerable extent, this alteration is probably not primitive, but more a *consecutive* state, depending upon the dissolving and *maceration* of the villosities in the choleraic liquid.

Fig. 22. The fatty globules on the liver are agglomerated, are of different sizes, and spread here and there in little clusters among the cellules of the liver, which also contain a greater number of the fatty globules than in the normal state.

*Results of the Analysis of the Milk of Cows Suffering from Rinderpest Obtained at Evening Milking, November 17.

No. of sample	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
Total quantity of milk obtained ..	9 oz.	9¼ oz.	5¼ oz.	2¼ oz.	2¼ oz.	Average cow's milk.
Density	1027.8	1024.4	1030.05	1021.8	1026.6	
Water in 1000 parts.	903.100	866.166	857.282	813.60	875.311	870.20
Solid matters, " ...	96.900	138.834	142.834	186.40	124.69	139.80
Casein, " ...	52.0870	51.030	54.295	34.921	54.880	44.80
Butter, " ...	27.7180	70.279	63.689	129.314	48.401	31.30
Sugar of milk, " ...	7.7210	8.463	14.740	12.820	12.345	47.70
Soluble salts, " ...	5.9755	3.798	4.166	4.795	4.873	6.00
Insoluble salts, " ...	3.3985	5.264	5.834	4.550	4.191	
Day when animal became affected	Nov. 17.	Nov. 16.	Nov. 15.	Nov. 16.	Nov. 16.	

†The specific gravity of the urine rose with the charge of albumen and excess of urea, from 1021 (urea 1.71 per cent.) to 1034 (urea 5.47 per cent.), in which last case, that of a cow slaughtered on third or fourth day of disease, which had suffered great dyspnœa during life and showed most marked pulmonary emphysema after death, on the addition of nitric acid to the urine, and without concentrating, a large amount of nitrate of urea separated out. (Cattle Plague, p. 78.)

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in those of cholera. We would then have the confirmation of what must remain for the present as a probability, that in all zymotics such an order exists; and that leaving out of view those where the process of the decarbonization of blood in the lungs is arrested at the outset, or in the earliest stages of attack, this order is in most of the pestilential classes of disease much the same; making a fair allowance for incidental changes in the terms of the series by way of permutation. This order in cholera, as determined by the ingenious researches of Dr. Schmidt of Dorpat, marks the steps by which the constituents of the serum transude into the alimentary canal, and after such action has been established for a little, those of the blood corpuscles move into the serum. This order is as follows: First the water of the serum (and of the blood-corpuscles in turn) passes before the solids, then the inorganic before the organic solids; next the *chlorides* before the phosphates; and last the salts of *soda* before those of potash. And in giving this summary, it is interesting to observe that the order, as Dr. Aitkin says, "is very much the same as takes place during the action of some purgative medicine, such as *elaterium*."*

Now although it would be appropriate for those versed in Pathological lore, and standing in the foremost ranks of science, or those capable of such intricate research, to compare the gradual withdrawal from the vital circulation of these essential constituents, with the symptoms which such successive drains upon the fountain of life produce; we may be pardoned in the attempt to draw attention to such considerations as next demanding elucidation in the advancing progress of Pathological inquiries, if we interpose an inference. Dr. A. Gamgee has intimated that the disappearance of chlorides from the urine, indicates the existence of pulmonary trouble, not hypostasis, carnification, or serous effusion, but what is popularly, as we have noticed in our earlier pages, termed difficulty of breathing, &c., in short, a state bordering upon asphyxia. Now, as it is fair to presume (at least until science by exact methods has determined otherwise) that the chlorides leave the serum at a stage in the Pest corresponding to that when they move in cholera; but whether at this time or at this stage in the process the bases of soda and potash go also or remain a little longer in the circulation, so that a disengagement of chlorine takes place in the blood, and is carried to the lungs in greater or less quantities, producing the partial asphyxia in the Pest commonly as before

* Science and Practice of Medicine, Vol. I, p. 606.

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(p. 314) ascribed to nervous irritation, or that more general suspension of the aerating action of the lungs occurring in the algid state of cholera; it may not be wholly pertinent or appropriate in us to inquire. We may venture at least upon such themes when we come to the therapeutical part of our labor.

Stopping only to draw the attention of the scientific reader to the similarity in form, of the crystals produced by the changes in the saline constituents of the blood, effecting in their singular escapade from the vascular system, new combinations on the surface of the tissues; we ask the expert in such microscopic crystalography, to say whether the cubical crystals Gamgee observed* are the same as those seen† by Perigoff; and then we would invite the attention of the Chemico-Physiologist to their true substance and composition: and if truly ammoniated phosphate of magnesium, to explain by what process, and in which of the series of saline degeneration, as just stated, they are formed.

But let us bring this extended pathological summary to a close; and claim, without any further attempt to substantiate the thesis; that it is necessary, in order to embrace the various cases set forth in our earlier tracings of symptoms and morbid anatomy, and to bring unity out of their apparent diversity, to propound the following classification for the main varieties or stages of the Pest.

1. The *Congestive* or *Catarrhal Stage*, presenting the disease in its simple and uncomplicated forms, where the lesions do not extend deeper than the epithelial coat of the mucous membrane, wherever affected.

2. The *Emulsive* or *Hyperæmic Stage* in which the mucous membrane is softened (more so in all probability by its own ejections lying in the concave folds of the intestine, &c.); pours forth mucin in thin form, and is sometimes in parts completely degenerated, losing its hold on the muscular coat. (See p. 283, &c.)

3. The *Exudative Stage*, where the separation of lymph proceeds, and croupous casts or diphtheritic deposits are formed or poured out (like polypus). See pp. 280, 281, 286, &c., and plates VI, figs. 1 and 2, VIII, figs. 3 and 4.)

4. The *Suppurative Stage*, when the follicular growth takes on a pyoid form, and granulations are attended with purulent destruction. (See pp. 284, 286.)

It is only necessary to add that it is highly probable, giving due weight and place to the evidence adduced by different observers,

* Page 209, Pl. X, figs. 3, 5 and 6. † Page 338, note on figs. 10 and 11.

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in various climes, and in successive outbreaks, touching the inoculative as well as natural forms of the Pest, that the largest number of cases would be found occurring and terminating either favorably or fatally in the first stage; and that the residue would be ratably proportioned among the other stages, in a ratio, declining with the advanced complications which they respectively portray.

III. Treatment.

The treatment of a distemper so insidious in its attack, subtle and masked in its incubative stage, and if left unchecked, so fearfully fatal in its development, demands a method that shall be prompt and resolute, and based upon the calmest conclusions of science. All empirical modes should meet with a sturdy rejection. *Blood-letting*, and the vulgar *nostrums* of farriery, should be *discarded*. The veterinary who has not thoroughly grasped by careful study the scope and action of this zymotic, should be denied a consultation or a fee. It would be better to trust to nursing and to nature than to him. For his professional blunders might, by the myriads of germs of pestilence created and diffused under his unskillful eye, add to the dumb creature his bungling destroys, holocausts of sacrifices to his quackery. It would be otherwise with the instructed and intelligent expert.

Veterinary science is now invoking to its aid the most eminent pathologists and therapeutists of the age, in order to secure the mastery of this disease. And this should not only be a cause of gratulation to all agriculturists of whatever nation or clime, and a source of hope for the future; but it should inspire all further investigation, and the handling of every case, wherever and whenever it may occur, with the same feeling. We do not hesitate then to say, terrible as the pictures of such desolations as have been wrought in Great Britain may be, that the treatment of this pestilence in any new country it may visit, should, from its first onset, be courageous and hopeful. The arm of science thus nerved strikes always for victory. And with the facts fresh in our recollection that the Eczema which broke out in England in 1839, and the typhoid or exudative pneumonia which followed in 1841, have lost all their terrors, and can only be found in a few sporadic cases in enzoötic form; we rejoice that the Edinburgh Committee, through Dr. Wood, their chairman, have proclaimed their faith that this epizoötic is to become milder in its type, and that its fatal ravages will be notably diminished.

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Should this disease ever hold an extended reign in this country, not the knife but scientific treatment will check and overturn its empire. If the farming population, and those to whom cattle are a necessity, not only for milk, but for the purposes of labor and breeding, can be duly advised of the latter method, they will not be compelled to resort too unfrequently to the former. But it is not meant by this that science is indifferent to those wise measures of precaution embodied in salutary enactments by the legislative authority. Isolation and quarantine are an essential part of scientific treatment, and unless these can be secured, and, with other approved remedial agencies, applied skillfully and opportunely as to time; destruction and instant burial with the use of disinfectants are the only alternatives left to incaution and ignorance. As science cannot accept the rude instruments with which fear always urges ignorance to arm itself, so the common sense of practical men soon revolts from their long continued employment.

The proprietors and tenant farmers of Kincardineshire, by memorial addressed in February, 1866, to the Privy Council, stated that until a then recent period, they were of opinion with a great majority of her Majesty's subjects—

"That stamping out by slaughtering all diseased animals, and those in immediate contact with them, was the only remedy; but that within the last few weeks a great change had taken place in your memorialists' opinions regarding this matter, in consequence of the successful treatment of the Plague in the parishes with which your memorialists are connected." . . . &c.

After stating that on certain farms eighty cattle had been cured and only one died, and their belief that by pursuing such treatment, ninety per cent at least might be safely brought through the dreadful Plague; they besought the Honorable Council to act under a proviso for such purpose, expressed in the Cattle Plague Act of 29 Vict., Chap. 2, and to exempt from its operation (*i. e.*, the slaughter of infected animals) for a *period of two weeks*, all cattle coming under the immediate care of the Inspector whose treatment of the disease had been so successful; to the end that if the experimental trial thus to be sanctioned should have a successful result, a like measure of relief might be extended to other districts. Strange to say, the Council refused to give a beneficent and liberal interpretation to the clause referred to, fell back upon the alleged original understanding of its purport by both Houses of Parliament; confined its interpretation to experimental cases under the direct

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charge of the Cattle Plague Commissioners, and refused the prayer of the memorialists. We pause a moment to remind the reader that more benign and less ambiguous provisions mark the enactments of law adopted by the State of New York on the recommendation of its Agricultural Society.

The "stamping out" process it is conceded, may effect the end it proposes within certain limits, provided these are sufficiently extended to comprehend all infected cases. But if the quarantine prove to be an imaginary one, or if the pestilence has broken out through atmospheric agencies and has extended itself beyond the limits of frontier or local cordons, then when the maladroitness of fancied security has been foiled, and all the allied antagonists to scientific methods are prostrated, this *brutum fulmen* recoils upon its abettors; and the appeal that then comes to the skill they despised loses the full measure of benefit to have been secured at the outset, had better, not baser agencies been employed.

These are the plain practical lessons which the histories of all epidemics in the human family, and of all plagues among the brute races, clearly and invariably teach. They mark the bold uprising and clamor of empiricism, and in its successive overthrows by the strides of pestilence they point to the modest but masterly persuasions and trials of science for true and enduring relief. And if we seem to dwell upon such teachings, it is because we are conscious that as "the still small voice" followed the tempest, the earthquake and the fire, and the preparations for it was not until these fearful manifestations had awed the querulous, and doubting prophet; so it always is in the face of mortal pestilences that the howlings of terror, the onslaught of savage phrenzy and the fierce desolations of misguided zeal, precede the calm and benign intuitions of mercy and judgment, which make up what we call science, and give to it the radiance of a divine vision.

Happy are those who are saved from the period of agitation. tumult and dismay, to witness the return of serene and successful counsels and procedures. Most fortunate is the people who, anticipating this as the natural order of events wherever prejudice and passion hold their course, use all their energy and wisdom to cut short or forestal their sway, and hasten to usher in the reign of order and method.

As above intimated, we have to propose, before we conclude this branch of our subject, a method of treatment to be approved by the Society, and as we hope, also by minds versed in or attracted by

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scientific investigations. But before we proceed to so responsible a venture, we will pass in review the various methods pursued by the different schools in medicine, and by distinguished veterinarians and practitioners of the medical Art; and to avoid repetition, such as contribute to the scheme we may propose will not be particularly dwelt upon in this general review.

The different schools have been fertile in their inventions and modifications of the treatment pursued, whether prophylactic, hygienic or curative. Of these, the Allopathic, as the older and with a larger discipleship, is first in the order of our sketch, and of this school in Great Britain, Smart and Gamgee may be ranked as the leading authorities. In connection with the former, the Edinburgh Committee, made up of highly distinguished physicians and veterinarians, &c., deserve marked attention.

Dr. Smart, who claims to have had considerable success in the treatment of the Pest, a *summary* of which we quote from his Report to the Lord Provost and magistrates of the city of Edinburgh, *in extenso;* has, after insisting upon careful and assiduous nursing, proposed three kinds of drugs as all he found requisite to employ, to to wit: **Laxative*, with diuretic action—†*Stimulant* (also possessing diuretic and diaphoretic properties); and as *Tonic*, one and a half ounces of powered cinchona bark of the best quality, to be used when convalescence is fully established. This last is given in the early period of convalescence in combination with the stimulant, and at a later period with a quart of good sweet ale, given once daily and at night. He recommends, also, that two table-spoonfuls of laudanum be added to any of the mixtures prescribed or combined with its food, to control excessive diarrhœa, or obviate straining.

His plan of diet requires the use of simple food, and until decided convalescence, well cooked, and given in small portions at regular hours. The *full* diet, (devised, according to Gamgee, by one of the best managers of cows he ever knew, who was in attendance at Smart's experimental byres) is composed of—

"Four handsful each of bran and brewer's draff; one pound of peasmeal; two pounds of mashed turnep (well boiled), not too

* Laxative.

Nitrate of potash, } of each 1 ounce.
Powdered ginger, }
Powder of sublimed sulphur, 2 ounces.
Treacle, 1 pound.
Water to make a quart, and well mixed.

† Stimulant.

Carbonate of ammonia, ¾ of an ounce.
Sweet spirits of nitre, } of each 1½ ounces.
Spirit of mindererus, }
Cold water, 9 ounces.
Mix.

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thick, and given *night* and *morning*. At *mid-day* a gruel is given, of two pounds of oatmeal, well boiled in six quarts of water. In addition to these, some raw turneps (two pounds, for example, of greentops), and one pound of hay, may be allowed in small quantities during the twenty-four hours. To allay thirst, three to four quarts of water, previously boiled and allowed to cool, are given in mouthfuls during the day.* This constitutes the full diet of a decided convalescent. *Half* of this diet is, in most instances, during the acute course of the disease, *too much*. In all cases the same kind of food and periods of giving it are followed. There are some animals that for a time refuse all food, not excepting gruel. In such cases the gruel is administered by the bottle thrice daily, along with or after the medicine. The animal should get a little mash so soon as it takes it voluntarily. It is often expedient to miss a meal, especially whenever symptoms of an unfavorable indication appear. These are not of unfrequent occurrence during the course of treatment. Grass is given, and the quantity of hay and turnep increased as there is progress toward more perfect recovery."

His summary of treatment is as follows:

1. The animal is at once taken from its ordinary food and separated from the rest.

2. It is to be placed in a well-aired byre or house free from draughts, and the temperature of which is maintained at 70° Fahr. or 75° Fahr.

3. It is to be well rubbed down, and thoroughly cleaned and covered with a good rug.

4. If there be constipation, begin with the laxative and continue night and morning, or if required, oftener, until there is free scouring.

5. Let there be no delay in giving the stimulant, and, if needful, combine it with the laxative.

6. Defer giving ale and bark until convalescence appears.

7. To obviate straining or excessive purging, two tablespoonfuls of laudanum, night and morning, may be added to other medicine.

8. Be careful to avoid overfeeding, as an error in diet may prove fatal.

9. See that the cow is well milked night and morning (even when there is no yield), during the course of the disease.

* Many of the diseased animals evince a remarkable predilection for charred wood; and as carbon is an excellent antiseptic, it is only obeying a natural indication to supply materials to satisfy this craving. To do so, charred wood may be boiled with the water, and a few small charred branches of trees placed in the stall.

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10. All the droppings should be at once disinfected by solution of chloride of lime, and quickly removed.

11. The affected animals should be frequently and closely observed, and threatening indications treated as they occur.

We give also in a note,* several examples of successful treatment, which may serve as a guide as well as encouragement to the uninitiated.

The Edinburgh Committee, in their Interim Report, made up in a week after their appointment, "deprecate and strongly protest against the system of indiscriminate slaughter," &c., and regarding Rinderpest as evidently a disease of a low type, and the tendency to death to be by exhaustion, conclude that violent and lowering treatment is wholly inadmissible, &c. So also with strong saline and gastric purgatives, in the place of which Professor Dick, one of the committee, takes *linseed oil* in doses of sixteen ounces, to which is added half a mutchin (*Ang:* pint) of *whisky.* For the relief of scouring, he recommends the use of *lime water* in quart

* *First Case.*—A cow from an infected byre in the Canongate, admitted on the 21*st September*, was very weak, and expected to die the same night; the breathing was labored and sighing, and the animal was cold all over; had taken no food for five days previously; the milk and cudding quite absent during that period; put under treatment next day, when it was thoroughly rubbed down and covered with double rugs. As there was already scouring, it was ordered stimulants three times a day, and to be fed entirely on gruel. It got worse apparently for two days; scouring became excessive, and mixed with blood. *On the 25th* the cow was so well as to be allowed a little mash. The temperature was good, scouring less, and there was abundance of healthy urine. *On 26th and 27th* there was no apparent progress; the breathing was very oppressed; pulse 100 per minute; not strength to rise; breathless and exhausted after every effort. *On the 28th* it was decidedly better; warmer, more animated, looked eagerly for the gruel; urine abundant; the dung more natural. Bottle of ale and stimulant mixture twice daily. *On the 29th* the cow eat too freely of hay; relapse of twenty-four hours, accompanied by much diarrhœa and straining; corrected by a tablespoonful of laudanum night and morning. During the next few days some progress toward recovery was made. Had stimulant twice and sometimes thrice a day, and in the evening ale with tonic powder. *On the 4th of October* the pulse was 72, and getting stronger, and the respirations were 36 per minute; food consisted chiefly of gruel. Convalescence now appeared and became decided. The cow was more lively—no scouring. Temperature good; the hide over the back and on both sides of the neck was puffed up with air under it (general emphysema of the cellular tissue); when struck emitted a drummy sound. *On the 5th,* unequivocal sign of advanced convalescence evinced—cudding. Two small mashes, with a little turnep and grass, the stimulant mixture twice, and at evening the bark in warm ale and gruel, constitute the daily food and medicine of the animal. Milk returning; pulse and breathing natural; the cow quite recovered. Puffiness of the skin every day getting less.

Second Case.—A cow from an infected byre; put under treatment *on the 28th September;* had taken no food, nor been seen cudding for two days previously; pulse 96; constipation, and loaded paunch; vagina shewed the characteristic color; treated with laxative mixture night and morning. *On the 1st October* the pulse 96, weak; respiration 72 and oppressed. Free scouring, lasts all next day; moderated by a tablespoonful of laudanum night and morning, along with the stimulant. *On the 2d,* signs of convalescence; takes a little

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doses, to which laudanum, from one-half ounce to an ounce, is to be added. These remedies were to be followed by a *stimulant* treatment, (or it might be simultaneously administered), to wit, *carbonate of ammonia* in six drachm doses, three times a day. The tonics promotive of convalescence are, *sulphate of iron* in half ounce doses twice a day or the powdered *bark* recommended by Dr. Smart.

In a subsequent paper, the committee classify their treatment under four heads:

a. Diaphoretic and stimulant.

b. Acid treatment.

c. Restorative treatment without drugs.

d. Prophylactic treatment.

Under the first, a *vapor bath* is administered once or twice a day, and for successive days, according to circumstances; the animal being placed in a box or stall whose sides are an inch or so higher than the patient, covered with a tarpaulin thrown over the box so as to tightly enclose the animal except his head, and the hot vapor being kept up by throwing red-hot bricks into a tub of hot water, first placed in the box below the level of the floor, and so as to be easily accessible to the operator.

mash night and morning, but mostly gruel; scouring abated. *On the 4th,* convalescence more marked; pulse, breathing and temperature more natural; milk returning. *October 7,* all signs of returning health now present; takes small mash night and morning, with a little turnep, hay and grass. The milk is returning rapidly; breathing tranquil.

Third Case.—Cow from an infected byre; admitted on the *29th September;* all the marks of disease present; pulse 100 and weak; breathing oppressed; no appetite; very depressed and thirsty; reddened vagina and gums; constipation. Had laxative mixture, and freely scoured by a single bottle. To have stimulant mixture three times a day; remains in an undecided state during the next *three* days, refusing food, except gruel and a little thin mash. *October 3,* the pulse 60, and respiration 48. The cow is more lively; eats a little better; same treatment; to have a tonic powder and ale at night. *October 6,* pulse still high—80; the respiration 48; the breathing oppressed; otherwise, not markedly changed. *October 9,* signs of convalescence quite decided; appetite restored; takes full meal of a convalescent quite greedily. The milk increased in quantity; improving in quality; pulse and breathing still a little too high. This arises from a slight attack of pleurisy, caught since admission to the byre.

Fourth Case.—From an infected byre; admitted *26th September;* taken no food for two days; dull; losing milk; oppressed breathing; pulse 100; signs present reddened vagina and gums. Laxative mixture given; free scouring next day; stimulant treatment; small mashes twice a day; gruel at mid-day. *On the 1st October* the pulse was 96; respirations 48; temperature natural; animal dull; no appetite. *On the 2d,* improvement; stimulant twice a day, and ale and bark at night. *On the 9th,* convalescent; milk increased in quantity; improving in quality; gets full diet; takes it eagerly.

Fifth Case.—Cow from an infected byre, where ten had previously died; admitted *1st October;* had all distinctive marks; treated on similar principles. *For three days* pulse 95, and respiration 102; nothing specially to be noted in treatment. After seven days' illness, convalescent, giving full milk, chewing cud and taking full diet.

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The avowed object of this bath is "to promote the circulation at the surface, to relieve the congestion of the mucous membranes, and to eliminate the poison from the system."

To aid which desired results, and as not incompatible, stimulants are given:

1. *Oil of turpentine*, four table spoonfuls in a chopin bottle full of gruel, well shaken, and given twice a day—increasing the perspiratory effort, and superseding the use of a laxative.

2. *Infusion of coffee*, obtained by digesting two ounces of coffee roasted and ground, in a bottlefull of boiling water, for fifteen minutes, and when sufficiently cool given every six hours.

3. *Carbonate of ammonia*, administered three times a day in half-ounce doses, in a bottlefull of gruel, to which may be added three drachms of nitre.

The Acid Treatment is suggested in consequence of the alkaline state of the secretions, and consists of:

1. *Dilute muriatic acid*, three drachms, twice a day, in a bottlefull of gruel.

2. *Vinegar*, also in the gruel, two ounces given four times a day.

The Restorative treatment demands full accord with

1. *The general sanitary instructions* of the commission as to cleanliness, use of disinfectants, regulating the temperature of the byre so as to keep it up to 65° Fahr., or 60° Fahr. at least; the banishment of hay, straw and all kinds of fodder from the stall, as well as manger, &c.

2. *The regulation of the diet*, so as only to give oat meal or barley-meal gruel, or linseed, hay and bran teas, to which, in the earlier stages of convalescence, well boiled turneps or carrots may be added; not even a handful of hay being permitted until rumination is re-established, and that first dampened with *water* which has been *salted*.

3. *The keeping of the animal warm*, by rugs or other appliances.

4. *The use of good, sweet ale*, at the rate of two chopin bottles three or four times a day.

The Prophylactic Treatment, recommended with a view of preventing the development of the disease, or of modifying the intensity of its symptoms, &c., consists of:

1. *Sulphite of soda*, one ounce in a bucketfull of water, and given morning and evening.

2, *McDougall's solution*, a wine glass in a bucketfull of water. twice a day.

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3. *The sulphite and solution* combined, to wit, a half ounce of the first, and two table spoonfulls of the second, given as above.

Gamgee, while challenging for his practice as many recoveries as are gained by his opponents, affirms that—

"No known remedy restores an animal once severely attacked, and the administration of medicine is, as a rule, not required to save the small percentage which may recover."

Winding up his hopelessness as follows:

"But if any one wishes to test the effects of medicine in this disease, let him treat at least one hundred animals on any one system, and leave another one hundred to nature, having a proper regard for their comfort and judicious hygienic management."

He proceeds to account partially for the laurels won by Homœopaths in South Holland, by noting as one of the strange variances of outbreak in Great Britain, that—

"Dutch cattle have suffered less than our own, both in Holland and Great Britain."

In the absence of definite information, we are left to conjecture whether his methods were as numerous as those of the empirics to whose treatment he professes to have given close observation, or as those of the remedies employed and of which he gives an extended notice, though prefaced by the slur—

"Some animals recover despite the mode of treatment."

Alluding to the recent method of *subcutaneous injection*—

"As of tincture of aconite, belladonna, and other alkaloids which do not *irritate* and *inflame* the tissues"—

he next describes the system of *injection into veins*, in the use of—

"A pint or quart of water at 100° Fahr., injected after the like amount of blood has been taken from the jugular vein . . . ., to be tried in the early stage of the disease and . . . . with result of purgation, action on the kidneys and free exhalation from the skin and passes to the class of *External applications*, inclusive of the ordinary methods—

"Of applying heat, cold, rubefacients and blisters to the surface of the skin."

Those less known and partially commended (while actual cautery is very wisely discarded as barbarous), are—

1. *The vapour bath.*—Covering the animal (head excepted) with woolen rugs, propped up and out by sticks, &c., and then heating the air between the rugs and the skin by a spirit or gas lamp . . . .

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2. *Mustard poultices.*—Which should be large, warm, and applied with a rug to the body, so as to be kept on for three or four hours . . . .

3. *Rugs dipped in boiling water*—wrung out thoroughly and applied to the abdomen.

Elsewhere, mention is made of the *hot air* and *vapor baths* which have been used with some success in Russia, and were thought to be of sufficient importance to form the basis of a dispatch from Sir A. Buchanan, the embassador at St. Petersburgh, to Earl Russell, in October, 1865.

The vapor bath, originated by Thaer, who applied it with success in the murrain of 1828, is taken over a kettle with a plank cover perforated with holes, sunk into the ground and so built up that fire may be kindled under it, and when steam or hot vapor is evolved, the sick animal covered with a woolen cloth next to the skin and a linen one outside, is kept over it from thirty minutes to an hour; then rubbed dry and kept perfectly warm; allowed gruel, &c.

Many recoveries were detailed by the Russian farmer who communicated its use. Like results also followed the practice used and commended by Mr. Graham, of Capellie, near Glasgow, in his hydropathic application of *cold* water:

"The diseased animals were packed in three heavy horse rugs, saturated with water, about which were closely applied three other rugs; and received an internal remedy* during the packing period.

The Internal Remedies, as classified by Gamgee, are as follows:

1. *Purgatives*, which in drastic cathartic doses he properly condemns, as mild laxatives he tolerates, though he had as much success in cases where he made no attempt to relax the bowels as where either mild or active purgatives had been prescribed, giving a prescription† not apt to induce much purgation, and to be followed by a bottle of *linseed oil.*

2. *Enemata;* too much overlooked as medicinal agencies and as means of nutrition. They may be given first to move the bowels by dislodging contents of larger bowels; second, to restrain them, in the use of a pint of *starch emulsion*, containing one ounce of *laudanum.*

* Three tablespoonfuls of sulphur.
Three tablespoonfuls of nitre.
Half a tablespoonful of ginger.
One pound of treacle.
In warm water.

† Sulphate of magnesia, 12 oz.
Sulphur, 4 oz.
Spirits of nitric ether, 1 oz.
Nitre, ½ oz.
Water, 1 quart.

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3. *Diuretics*, of which *nitre* has been principally used, but "it is apt to weaken, and must be prescribed in moderation, and it has no specific action of value." *Oil of turpentine* is diuretic, as well as stimulant.

4. *Diaphoretics*, in the use of warm clothing, heated air, &c. (as before referred to), adding the internal use of *liquor ammoniæ acetatis*, to those before mentioned.

5. *Stimulants.—Whisky, brandy, spirits of wine*, in two ounce doses, every two or three hours, have been frequently administered; "some animals have recovered, whilst others have died."

Carbonate of ammonia, in half-ounce doses, has been largely employed, and "seems to agree as well as anything with the sick animals." Strong *ale, porter, port wine*, &c., should be used in the stage of convalescence.

6. *Sedatives*, not resorted to in any great extent. *Tincture of aconite* in 30 drop doses, has been administered at frequent intervals. *Extract of belladonna* and opium have been principally chosen from the narcotic list, as affording the best *chance* of regulating the condition of the bowels.

7. *Neutral Salts.*—The *nitrates and chlorates of potash* and *acetate of ammonia* produce favorable effects upon the blood in febrile disorders, and activate the secretion of the skin, kidneys, and mucous membranes generally. They may be administered singly (or combined with *carbonate of ammonia*) in moderate and repeated doses, and dissolved in a considerable quantity of water.

8. *Tonics*, vegetable and mineral, may be used with benefit in the convalescent stage if not given in doses so large as to induce derangement of the stomach and bowels. The *decoction* of *cinchona* or Peruvian *bark*, and the *infusion* of *gentian* may be given about an hour before feeding, &c. *Sulphate of iron* is the best tonic, and should be given in the food in drachm doses.

9. *Antiseptics.—Condy's fluid*—the red solution of the permanganate of potash—in water alone, or water slightly acidulated with *sulphuric acid;* two ounces of the fluid every two hours diminished the fœtor of the excrement. Small doses of *carbonic acid, sesquichloride of iron*, or of *chlorine water*, produce similar effects.

10. *Mineral Acids.—Hydrochloric* (formerly known as muriatic) acid, and *sulpuric acid*, more frequently have been vaunted as specifics. *Nitro-muriatic acid* is serviceable in the convalescent stage.

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Mr. Priestman (whom we may remember as the veterinary surgeon first consulted by Mrs. Nichols) has suggested a mode of treatment which, according to the statement made by Dr. Hayes, and found in Sequel to First Report, page 13, has proved most successful.

The same hygienic conditions and mode of diet as commended by Smart are preserved; half-ounce doses of *carbonate of ammonia* and *nitre* are given, night and morning, in cold water, as a prophylactic, and when symptoms of the Pest appear, two ounces of *chloric ether* are given in gruel three times daily, and when they abate, two ounces of a mixture consisting of equal parts of tincture of *gentian*, tincture of *ginger*, and *aromatic spirit of ammonia* are given night and morning.

A *chalybeate* remedy for the Pest, based upon a large experience in Poland, was brought to the knowledge of the Royal Commissioners through a dispatch from Major Mansfield, the Consul General at Warsaw, to the British Secretary for Foreign Affairs.

On a Polish farm there existed a chalybeate spring, and the cattle drinking of it "were either but slightly affected or recovered after drinking profusely of it, while on the adjoining farms the beasts died in large numbers, It was then found that by putting old iron into the cattle troughs, so as to produce a highly chalybeate water, the same result ensued, and the cattle recovered."

Hence, doubtless, has followed the suggestion of pouring into the drinking-trough for cattle a little *sulphur* and a drachm of *sulphate of iron* and a half pound of *salt* every day, for each large beast.

Dr. Druitt recommends the tincture of the *Sesquichloride of iron* the *Trisnitrate of Bismuth* as a deodorizer of the alimentary canal, and *yeast* in large quantities in addition to those we have previously noticed. Fourteen out of twenty Dutch bullocks were cured by Mr. J. Hutton through the agency of ammonia and tonics.

"Stimulants were administered as required. All the water used for drinking was medicated with mineral acids, and the beasts frequently washed with water impregnated with ammonia."

Prescriptions have been confidently recommended by veterinary chemists and doctors of medicine, of which we may quote two specimens:

Chlorate and nitrate of potash, of each one ounce; *Hydrochloric* (muriatic) *acid* and powdered *opium*, each one drachm; to be mixed in a pint and a half of a *decoction of linseed.*

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Chlorate potash, common *salt* and *nitre*, each one ounce, to be dissolved in a pint of hot water, in which an ounce of *dilute hydrochloric acid* has been mixed; the dose to be administered in gruel, &c.

Mr. Moffat's prescription consisted of:

Chlorate of potash, three drachms, *tartar emetic* five grains, and *carbonate of iron*, fifteen grains.

Those of Mr. Crotch, M. A., Dr. Carr and Mr. Wilson severally commending, "the injection into the venous system of antiseptic and parasiticide salts, of which the *hyposulphite of soda*, the *permanganate of potash* and the *perchlorate of soda* are specified—the frequent washing of eyes, face, &c., with *vinegar*, and the internal administering of a pint or more daily—a pint of fresh *yeast*, added to a like quantity of *beer*,—put in two quarts of gruel, and given three times a day;" electricity, the electro-voltaic pile, ... cod liver oil balls; bleeding to fainting, and giving a bottle of brandy to revive; calomel and fumigation with mercurial vapor; prescriptions having cayenne pepper for their bases,* complete the list of allopathic nostrums, after we have have given that of Mr. Heatley, of Market Drayton, as follows:

"Take of spirits of *turpentine* one ounce, and of *castor oil* seven ounces, to be given only once as the first dose; take *sesquicarbonate of ammonia* and powered Peruvian *bark*, each one drachm, powdered ginger thirty grains, and *peppermint water* six ounces, to be taken three times a day. Boil one ounce of *mutton suet* in a half pint of new milk, strain and give every night; and give four ounces of *brandy* in a half pint of *linseed tea* every morning. Each of the above doses to be increased or decreased according to circumstances."

The limits of this Report will not permit an extended review of these various prescriptions; and it is doubtful whether it would be possible to assign any satisfactory reason for the successful action of many of them, if such could be truly predicated.

It would be unwise for instance to rely upon a remedy as a mere de-odorizer of the alimentary canal, inasmuch as such an agent would be unnecessary if convalescence were once established, and useless, if it did not exert a decided influence in mitigating the fury of the disease. It is also to be observed on the most cursory examination of the list of therapeutic formulæ we have given, that many neutral salts, such as the chlorates and nitrates of potash, &c., and others of which sodium is the base, enter as chief ingredients;

* Gamgee's Cattle Plague (*et ubi sup.*), p. 104–116.

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their combination with acids, stimulants, sudorifics or narcotics, promising to their authors some remote chance of relief. We are far from asserting that these salts could not be supplied at certain stages of the Pest with decided benefit; but we point to these receipes more as exhibiting the sheerest empiricism, at least in the motley admixtures proposed by each enthusiast, and according to his fanciful conceit of their essential value. It is in this and not in any invidious sense, that we have as we think, very fairly designated them as nostrums.

Further on we will notice such of the remedies cited as from other analogies may claim to have specific virtue in arresting the peculiar ferment of the Pest; but now let us pass to the consideration of those which if given in a state of health in large and repeated doses, would tend to the development of a morbid action, very similar to that we are considering. This we need hardly remind the intelligent reader, brings us to the consideration of the homœopathicity of certain drugs, as curative in this distemper; and to the second branch of this review, that of the treatment pursued by the school, whose fundamental axiom is "*similia similibus curanter.*"

The Homœopathic school has not been without ardent advocates, lay as well as professional, for its superior efficiency in the handling of the Pest. Its doctrines and method of cure, though hotly contested and decried when first announced, as bald quackery, have by undeniable success in a vast number of cures in the human subject, gained for it high commendation among the common people, and by gradual advances have extorted from opposing schools this high commendation,—that they have moderated the heroic treatment formerly in vogue. The "infinitesimal doses," derided as addressed only to the imagination, or only suited to ailments where "bread pills" would have been equally available, were gladly tried by Russian serfdom, during the terrible scourge of cholera which visited Eastern Europe in 1830; and we may add, approved by and through them, as the reports made to Admiral Mordinow, and since published by him, of large percentages of cure, sufficiently attest. The superior efficacy of the Homœopathic treatment of cholera to that relied upon by its opponents, was further demonstrated in the public contest instituted under the auspices of the Austrian Cabinet at Vienna. And since that day its marked success with many people in different climes, and in all the varieties of disease "which flesh is heir to," has given the system a popular acceptation, against which it is is vain for prejudice or self-interest to contend. Its doc-

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trines have withal been accepted by experts whose scientific attainments and high probity place them above the suspicion of sciolism and imposture. And while deprecating the absurdities to which many have partically carried its teachings, it is yet to be urged in the behalf of pure science, which holds all medical systems as at present in a tentative posture, that no hindrance should be interposed by the dogmatists of any school to the establishment and acceptance of facts of cure in any disease by any method; to the end that these may undergo the rigorous scrutiny which the inductive method demands, and by which alone medical as well as other physical sciences are to be permanently advanced, And this claim we may the more freely advocate, and with the high certainty that such advocacy will be sustained and shared in by all generous spirits who seek to pursue humane ends by scientific means; as the sequel will show, that we propose no blind adhesion to any system, and as the transition period, in which all present systems of medicine now stand, indicates a new and higher eclecticism based upon a more perfect classification of disease, and a more thorough demonstration of the agencies which afford the most prompt and certain if not specific relief.

Attention was first attracted in Great Britain to the successful cure of the Rinderpest by Homœopathic remedies, through the Report made on the Cattle Plague in Belgium, by M. Barron, Her Majesty's Secretary of Legation at Brussels, to Lord Howard de Walden. In this Report, after a review of the recent outbreak in Belgium (not theretofore visited by this scourge since 1814), and which, principally from the vigorous system of quarantine noticed in our first Report, was comparatively light, the successful cures of Messrs. Seutin and Gaudy in Holland were brought to the notice of the English Government, with a strong recommendation that these gentlemen, one a chemist and the other an Ex-Professor in a Veterinary College, should be permitted to verify their practice in England. Despite the alleged malevolence of the Dutch Veterinary Corps, the carelessness of the farmers whose cattle were under treatment. and the absence of proper assistance, a large percentage (from 70 to 80) of cures was gained; the results of the practice being *officially* certified in one commune, that of Mathenesse, as of forty-six cures in sixty-three cases. The proposition of these experts being based on an indemnity moderate in amount, to cover expenses and remuneration, was not accepted by the British Government, and no opportunity was afforded for a direct inspection

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and test of the practice. But as appears from an address of Lord Bury, Treasurer of the household, &c., before the General Committee of the Norfolk Cattle Plague Insurance Association, the friends of Homœopathy, requested Dr. Hamilton to go to Holland to investigate and report upon the treatment pursued by both schools. The Doctor was furnished with suitable credentials from Earl Russell to that Government. He found the Allopathic practice mostly confined to the use of *dilute muriatic acid* (in doses of one or one and a half drachms), combined in linseed tea, given four or five times a day, sometimes with *gentian*, *tormentilla*, and *ginger;* occasionally recourse was had to dilute *sulphuric acid* combined with *sulphate of quinine* in equal parts. By the use of these remedies, and with the external use of *carbolic acid* in proportion of eighteen drachms of the acid to forty quarts of water, or of *vinegar* and tepid water used four or five times a day, there had been a saving of 45 per cent. The Homœopathic treatment at Matterness, within a mile of Kethel, in the very centre of what had become to be styled the "black district," as reported by Dr. Hamilton, is also given by his Lordship, coupled with the allegation that the Royal Commission had refused to examine the Doctor as a witness, and the assertion of the consequent duty incumbent on the orator in common with every individual, to give as much publicity as possible to this fact.

The Homœopaths commenced their method of treatment on the 22d day of September, 1865, when eighty beasts sick with Rinderpest, as first vouched for by the certificate of veterinary surgeons, were put under their care; of which number sixty recovered. Besides these, two hundred and thirty beasts were put under Homœopathic prophylactic treatment, twenty-five showing the outbreak of the distemper before the preventive treatment had time to work; but up to the fourth week no other case had occurred, and on the 21st day of October, the commune was pronounced free from disease; the remedies employed being *Arsenicum*, *Phosphorus*, *Phosphoric Acid*, *Rhus Toxicodendron* and *Sulphur*.

Another able exposition of this method of treatment is given by Dr. Pope,* from whose well digested review of the symptoms of the Pest as they passed under his own eye we have elsewhere quoted (see pp. 273, 275). His observations were gleaned from over one hnndred and seventy cases which had occurred in his immediate neighborhood. Accepting Smart's view of the morbid anatomy of the Pest, he adopts his system of diet and care and finds that—

* See Monthly Homœopath Review, Feb. 1866.

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"Certain features of the Rinderpest are very like those of scarlet fever. Its toxæmic character, the congested state of the mucous surfaces, and the extensive desquamation of epithelium are resemblances of some importance."

And it is doubtless because of this similarity that Dr. Pope seems to rely upon Belladonna as of prime value; an instance being given of its efficacy in the hands of Mr. George Hope, a much respected citizen of York, who was determined to use his best efforts, and, as we judge, without any pecuniary reward, to mitigate the losses of his neighbors.

"An animal . . . was so far advanced in the disease that on Mr. Hope's visiting her he found that the inspector had been sent for to give an order for her shooting and burial. It was late at night, and as the order could not be carried into effect until the following morning, the owner was persuaded to allow medicine and gruel to be administered during the night. *Belladonna* was the medicine given, and by the morning the animal had so far rallied that all thoughts of destroying her were abandoned, and she made a complete recovery."

Another exceptional case of recovery in a late stage of the disease is given, in which—

"The cow was completely despaired of when first seen, and though she suffered to a very great extent from emphysema of the subcutaneous cellular tissue of the trunk, completely recovered."

Dr. Pope very wisely recommends Belladonna, in tincture, two to five drops to be administered every two, three, or four hours. He says:

"First, second, and third dilutions were tried in our early cases, but they were by no means so satisfactory in their action as the pure tincture."

The other remedies advised by Dr. Pope, with their corresponding indications, we will give in his own words, remarking that they substantially correspond with those recommended by the association for the trial of the preventive and curative treatment in the cattle plague, &c., &c., of which his grace the Duke of Marlborough is announced as chairman:

"*Arsenic* has been useful chiefly in meeting the prostration about the fifth or sixth day. As a prophylactic I question its value. If it have any, it is not in the sense that vaccination is prophylactic to small pox; but it simply acts by keeping the animals in good

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condition, and so enables them the better to resist the contagion giving rise to the disease.

"*Rhus tox.*—The chief indication for this remedy has been found in the muscular twitchings which characterize the disease in some of its stages.

"*Mercurius sol.* has been found valuable when the mouth has been long congested, and the patches of desquamation are general.

"*Ammonium caust.*, 1st dec., is of service where there is much abdominal distention, with heavy breathing and painful moaning.

Turpentine, 1st dec., has been of signal service in checking hæmaturia, a symptom which did not yield to Cantharis at all.

Secale cor., tinc., Mr. Emerton thought useful in one case of subcutaneous emphysema, and its proving shows that it deserves attention in this condition.

"*Phosphoric acid*, 1st dec., *Mercurius sol.* and *Arsenic* have appeared to control the diarrhœa more than any other remedies; but they have not proved altogether satisfactory. In any future case I should be disposed to try Muriatic acid or China. It has been a more difficult symptom to meet than any other.

"*Mercurius cor.* 1, has checked several cases of dysentery in very marked manner.

"In one case of apparently impending metastasis the acetate of copper, in grain doses of the first trituration, appeared to prevent its development; but it was the only case in which it was resorted to, and therefore much additional experience is required before its value here can be estimated correctly.

"In addition to medicines, much good has accrued from exposing the animal's muzzle to steam from boiling water or scalded bran. The nasal discharge is thus promoted, and large lumps of coagulated mucous are passed, to the great relief of the patient." . . . .

In brief review of this method of treatment, it is to be observed in all frankness that inasmuch as the present foundation of the Homœopathic system lies in its Symtomatology, no little difficulty must be experienced in applying it to the dumb creation. Besides the drug-provings which have been made on the human race, cannot with any certainty, or in some cases, even of probability be transferred to the brute races. This is more especially true of the ruminant orders, whose complex arrangement of the digestive organs would render the disparity of symptoms relating to the functions of assimilation, and of the reflex action upon the brain and cord from the direct influence of drugs acting upon the

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stomachic apparatus, more than probable. No such result might however be expected, when once the influence of the drug was felt, after it had been absorbed and entered into the blood circulation. Besides, as in this disease, the function of the first and second stomachs is quite suspended, and medicines carelessly administered (especially in large quantities) and thrown into the paunch, are as inert as if lying in their original packages; so it might happen in the administration of different drugs to obtain their provings, that different results would follow if these were thrown into the first or the fourth stomach. And after all, what could we know of their symptomatic indications so pregnant of suggestion in the various morbid states of the human subject, derived from provings on a nervous expanse, not only so delicate as to register at once every, the most trivial departure from the normal state, but so secure and protected in such registry as to confirm it by an unequivocal and audible tell-tale;—what could we know except by the loosest inference, when we seek the same intelligence from those to whom nature denies the power of speech. Hence, we are thrown upon the more tardy method of watching our provings of medicaments introduced into the system of any animal, by experiments on those doomed to slaughter, or massing the drugs, and leaving the proving to go on until death supervenes. So that not only as Dr. Pope remarks—"any nicety in the selection of a medicine to meet a particular case, seems well nigh impossible"—but all our reliable knowledge of the various scope of drugs irritative or destructive of nerve or tissue, alterative of the blood structures for a brief period, or exerting power until the full measure of poisonous disintegration is established, must be principally gained from *post mortem* observations.

We are not to be understood, however, as holding the view that in drug-provings on the lower races, there can be no symptomatology. We only insist that in the case before us, that of the ruminant tribes, it must be extremely limited, and that before such knowledge can be extended, a very elaborate system of drug-provings upon these tribes should be first instituted.

We are not left, however, wholly in the dark as to the fatal action of drugs in poisonous doses upon the brute races, as our toxicologists have made from time immemorial, frequent experiments illustrating such action, although mostly in dogs, rabbits and animals of small size and little value. From the records then they have given us, and until other more reliable data are furnished,

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we have to indicate as best we may the pathognomic signs, which point, on the Homœopathic principle, to the selection of the chief remedial agents which are best fitted for the cure of the Pest. We will detain the reader with a few examples:

Let us take in the first instance *Ammonium Causticum* and its ally of the same base, the *Carbonate*, which have in the hands of Dr. Smart and others, furnished many examples of its *specific* worth, and whose action we can best understand by the study of the main features of the poisonous action, or what may for want of more familiar phrase, be styled the Pathological Anatomy of the former drug. In men, we find its scope of action evinced as follows:

Redness of the Schneiderian membrane (covered in cases of intense poisoning with an albuminous membrane), also of the velum pendulum palati, of its arches, and of the posterior wall of the buccal cavity. The uvula is dried up, and covered with a mucous (epithelial?) layer. Redness also of the posterior surface of the epiglottis, and the rima glottidis, also of the trachea and bronchi. A few intensely red streaks in the mucous membrane of the œsophagus and stomach. Red spots in the ileum. (In dogs) the contractile power of the muscles extinct after death. Dark redness of the middle portion of the stomach toward the cardia . . . . Great fluidity of the blood, &c.

After examining the symptomatic provings of this drug, and especially its power to produce, "*violent oppression* of the chest; want of breath; desire to draw a deep breath (prevented by a pain in the region of the æsophagus) . . . . excessive exhaustion and muscular debility, &c.; trembling; chilliness; pulse at first small, afterwards becoming more rapid," &c; or those of its congener, the *Carbonate*, in producing as additional symptoms "swelling, itching and burning of the pudendum; painful varices of the rectum, with bloody discharge; burning pimples of the size of a millet grain, with a scarlatina rash over the upper part of the body; red, itching eruption (fluid and then becoming sometimes fetid), disappearing in a few days, &c.;" we can hardly fail to find some counterpart of the Pest in this drug. But we cite from the Edinburgh Medical and Surgical Journal for 1841, this interesting case:

"A young man who usually slept in a chemical laboratory, was poisoned by the fracture of a vessel containing nearly fifty pints of volatile alkali (liquid ammonia). The accident occurred in the night without his knowledge, and he was exposed to the vapors nearly an hour. He was aroused by violent constriction of the

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throat and dyspnœa. He arose, but felt suffocated .... The *mucous membrane* of the *mouth* and *nostrils* appeared to be destroyed, and bloody, frothy matter flowed from the mouth and nose. The tongue was of a bright red color, and had *lost most of its cuticular* covering .... The *dyspnœa* was extreme; *great thirst* .... *deglutition* almost *impossible*, *&c.*"

It is difficult, at least from the stand-point of the homœopath, to conceive how Smart's stimulant mixture, as he is pleased to style it, in which *Ammonium* appears in another form also, that of the *Acetate* (*Spiritus Mindererus*), could have had any special efficacy, unless *Ammon. Caust.* sustains a special relation to this disease. Nor is it easy for a disciple of Hahnemann to conceive how the secretions from the eyes, nose, bowels, skin, should be alkaline, unlesss the morbific influence should hold a close similarity in its action to that of an alkali.

We confess that we cannot find in *Arsenicum* any true rapport with the Pest. It corresponds in most of its provings too closely with certain stages of cholera to sustain a homœopathic relation with the distemper we are considering. It seems to have quite as destructive power over the peritoneal as over the mucous coat of the intestinal canal, and the common symptoms of erosion of the latter, of great prostration and fluidity of the blood, will hardly suffice as Homœopathic equivalents. Yet there may be cases as in the inoculations of Jessen, where the tendency to lymph extravasations, or others where extreme prostration and tendency to gangrene might justify its use as an intercurrent remedy.

With greater diffidence we venture the opinion that *Belladonna* can only be deemed a specific in cases where cerebral disturbanees are manifest at an early stage. True, we have the redness of the throat, &c., but not its swelling; nor the rash upon the skin, as in the human eruption of scarlatina, though there doubtless exists epidermic desquamation. And unless in addition to its action over the pudendum of the female, and the hæmorrhoidal veins of the male, it could be shown that Belladonna produced a true rubescence* throughout the alimentary canal, we should expect it to fail

* The *post mortem* of this drug shows in men, at least, the coats of the bowels inflamed, and parts not only red, but *black; blue* spots on the duodenum here and there; the jejunum, ileum, cœcum, and processus vermiformis, *lead colored* and soft in many places; lead colored spot of the size of a dime on the ileo-cœcal valve; the colon filled with hard fæces. The pancreas and liver have the same blue or lead color, the former softened, the latter crumbling and putrefied. The spleen is also crumbling and decayed. The lungs are dark blue, otherwise healthy; the heart livid and softened. The abdomen, penis and genitals are hard as a stone, emitting a frothy and fetid water when opened.

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in many instances, except where it was needed to assuage the excited condition of the cerebral vessels. We ought not, however, to have neglected to admit, as a common sign, the horrible smell produced in the cadaver.

If we are to look at the reddened aspect of the throat and fauces as a principal sign, why not turn to *Bromine*. Yet no one could confound the violent congestion of these parts, covered with coagulable lymph, with the exposure of these denuded surfaces in the Pest, except where protected by scales of epithelium; any sooner than a like mistake in the degree of rubescence in the stomach or bowels would also permit us to ignore the gangrenous ulcers, barely hid. And for a further illustration of the deceptiveness of the color of congested mucous surfaces, we may advert to that presented by the provings of *Bryonia*, where the cherry-brown color of the mucous membrane of the large intestines might easily be allied with that of the rectum in the Pest (though the absence of all inflammatory appearances in the rest of the bowels might serve as a means of discrimination), or a similar appearance of the stomach advise the homœopathicity of this drug to eczema epizootica. It would be interesting to trace the points of similarity exhibited in the action of *Cantharis*, *Croton tiglium* and *Helleborus* with doubtless many others that might be named, in their different action as to color and intensity of inflammation, with epithelial destruction in the mouth, fauces, bowels, &c. It is worth noting as we pass that in the first and last of these remedies we have the additional mark of the gall bladder filled almost to bursting, while in the second the correspondent redness of the rectum is not to be wholly distinguished from extravasation.

The plants of the Ranunculus order demand greater study than they have received. *R. sceleratus* is known to produce the affection termed by the German shepherds "coal-fire," the cattle declining to eat, tremble and shiver, and their abdominal veins become distended. *R. repens*, eaten by a flock of sheep, caused them to fall as if struck by lightning, their eyes rolled, their breathing was hurried and aggravated. Depletions were injurious. The mucous membrane of the eyes was injected; the mouth dry; abdomen slightly distended, and rumination ceased. Five ounces of the juice of *R. acris* introduced into the stomach of a dog developed a post mortem redness of the mucous membrane of the stomach, &c. *R. flammula* eaten by horses in large quantities produces distention

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of the stomach and inflammation and gangrene of the abdominal organs.

In this connection we may properly advert to *Aconite* (whose tincture, as we have seen, in thirty-drop doses, Dr. Gamgee recommends as a sedative), as this plant is also classed in the botanical order just alluded to. Its provings, like those of *Arsenicum*, adapt it to the choleraic branch of zymotics, although to different stages. The deep inflammatory blush it produces on the mucous surface of the œsophagus, stomach and bowels, as far as the cœcum, is accompanied with dark colored patches (these organs containing a viscid blackish-green fluid), attended at the same time with an enormous distention of the cerebral vessels, which, in the development of the drug symptoms, have caused restlessness, dimness of sight, stupor, and partial insensibility, accompanied with trembling, cold extremities, bathed (with the forehead in men) in cold sweat, blueness of lips and skin as if asphyxiated. The gall bladder is not distended, while the kidneys are somewhat engorged.

Dr. A. T. Thomson says:

"It acts first on the stomach, then on the nervous system, producing vomiting, hypercatharsis, vertigo, cold sweats, delirium and convulsions, which terminate in death . . . It resembles *Strychnia* in its effects on the posterior extremities when administered to quadrupeds."*

In cases such as those described by Egan and Pope and by Professor Simonds as occurring in Galicia (see pp.272,276), this remedy in the tincture, and in doses of five to ten drops, might be prescribed until the nervous twitchings and excessive diarrhœa were arrested.

Acidum Muriaticum, which in its dilute form was largely employed by the Dutch veterinarians, corresponds somewhat in the corrosive smarting, slight inflammation and agglutination of the eyes and eyelids, in coryza with an acrid discharge, and in the painful varices it produces, with some of the prominent symptoms of the Pest. Its value is not to be denied in acute disease (especially of a septic character), with rapid sinking of the vital force, and when the tongue is dark red, dry or covered with a viscid phlegm, lips dry, blackish and cracked, and the other symptoms last noticed occur. Its power also of assisting the gastric juice (perhaps of restoring it) must be conceded. But in the absence of any sure

* Materia Med. and Therapeut., Vol. 1, p. 570.

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experiments it may be conjectural whether its use in the early stages of the Pest would bring back to the stomachs their suspended activity. It may be that this acid may supply to the blood the loss, or may arrest the decomposition it undergoes when the chlorides begin to pass off. Dr. Thomson is unable to determine whether its tonic effects in diseases in which he had successfully employed it is to be attributed to its action on the nervous agency, or to its decomposition and the action of its chlorine; although from the effects of this ingredient in its uncombined state he thinks there is reason to incline to the latter opinion.*

We cannot find any proper correlation of *Secale Cornutum* with the Pest. This drug produces in countries where rye is used as a principal cereal, ergotism, both gangrenous and convulsive; as also a congenital form of this disease. The skin affections seem to us wholly different from the desquamatory or papular stages of the Pest-ferment, both as to color and action; and with the lungs and cerebral vessels turgid with blood, the ureters and bladders filled with watery, inodorous urine, almost to bursting, we have hardly a common sign except in the distended gall bladder. We cannot, therefore, concur with Dr. Pope as to the propriety of its use; unless where with an unusual disturbance of the skin function threatening its gangrenous destruction, we have colliquative diarrhœa, with spasmodic breathing.

Tartar-emetic or *stibium*, though used in some of the allopathic prescriptions, has no correspondence whatever in its symptoms or morbid anatomy with those of the Pest. Its most marked action is in producing inflammation and consequent hepatization of the lungs, and also thickness and opacity of the membranes of the brain. The mucous membranes of the mouth and intestines are unusually pale, while the peritoneal coat is of a brick-red color throughout, thus reversing the usual appearances as to color in the Pest. These, however, may be the appearances in the slow operation of frequent and small doses, while in the rapid poisoning (of dogs) the mucous membrane may be highly reddened.

Phosphorus (gout-producing ?), with its specific nourishment for an impoverished vitality, shows also miraculous power over the cerebro-spinal system when depressed or threatened with paralysis, in pleuritis, pneumonia, typhus abdominalis, acute exanthemata, &c. In its pathological anatomy, it intensifies the redness of the

* Ubi sup., Vol. I, p. 728.

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stomach and small bowels to a purple hue (sometimes in the ileum of a dark-red brown); and though the lining membrane of the stomach is easily separable, there is also revealed an intense redness (sometimes perforation) of the muscular coat (peritoneum and omentum also) with greenish thick fluid; that in the smaller bowels being ink-colored. Its power to destroy fibrin is so great when exhibited internally (in dogs) that no trace of it can be discovered, even with the aid of the microscope. Unless the Pest in its early stages had more than usual symptoms of typhus degeneration, or was marked with icteric coloration of the eyes and skin, its exhibition would be without reason or benefit. So too with *Phosphoric Acid*, available for zymotic affections, only in scurvy and choleraic diarrhœa.

Cuprum Aceticum produces bright red spots near the pylorus, but these are accompanied by black spots of the size of a pin's head. While the mucous membrane of the stomach and bowels is almost entirely destroyed under its action, the epithelium is not destroyed but thickened, with a tendency to gangrene through the entire track of the digestive canal; the spleen and lungs empty; the liver and kidneys congested; the lungs crepitating, and dotted with rose-colored spots, ecchymosed too, as also the bowels; the blood in the smaller veins thin and of a cherry-red, while the large veins and right ventricle are full of thick black blood; we have in addition to the bright red spots on the stomach above noticed, only a large gall bladder turgid with dark green bile with yellowish tinge, to tally with the abnormal coursings of the Pest. The principal sphere of this remedy is in the irritation of the ganglionic centers and of the medulla oblongata.

To pass, however, to other drugs, such as we have shown to be in extended empirical and allopathic use, for instance, the *nitrate of potash*, better known in common parlance as saltpetre. The redness which it produces in the stomach is not that of simple congestion of the capillaries, but it would seem of their destruction, as the blood is poured out upon the organ and then vomited up. Its homœopathicity lies in cerebral congestion, spinal irritation and the like; and though, besides what we have noticed, it produces sensitiveness of the pulse, causing it to flutter, it has no other correspondence with the symptoms of the Pest, unless such may be found in a dropsical œdema of the body.

Of the *chlorate of potash* we have but few provings; and these

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find no illustration from observed phenomena supervening from its use in poisonous doses.

In like manner we may dismiss *Terebinthinæ oleum* (turpentine), whose symptomatic action in this distemper has been given by Dr. Pope; *Sulphur*, whose potency in chronic ailments is brought out by the higher attenuations; *Iron*, valuable as an auxiliary to the blood in debilitated or cachectic constitutions; and the host of drugs, such as *ginger*, *gentian*, *tormentilla*, which in large does may serve as temporary stimulants in many affections, but are without specific efficacy in this.

Quinine produces in animals an enlargement of the solitary glands in the upper portion of the intestinal canal, which is very dry. The glands are somewhat inflamed. Some portions of the canal are slightly reddened, the muscular as well as the mucous coat of the smaller bowels is softened, and can be scraped off down to the peritoneum; that of the large bowels is similarly affected, but in a less degree. Its disturbing power in the human subject, when given in large doses, results in congestion of the brain and cord, red and white softening of the medullary substance and serous effusion; the softening and dissolution of the spleen, and blood congestion of the liver. It would be of principal value after the force of the disease is expended, in the palliation of the symptoms of marked exhaustion.

Rhus toxicodendron, *R. radicans* and *R. vernix*, valuable in paralytic affections of the extremities, in skin desquamations or hæmorrhages, and in zymotics of the typhus type, are without massive provings revealing their power over the mucous surfaces. Analogy alone can guide to their prescription after Pope's indication of symptoms, or where the burrowing of the Pest under the skin leads to the conclusion that it is directing its force upon this secernent expanse.

Here we may briefly notice *Chloric Ether*, prescribed by Dr. Priestman. It may be the *Chloral* of the modern school which is obtained by the prolonged action of *Chlorine* upon *Alcohol*,* hence

* *Alcohol*, represented by the chemical formula, $C_4 H_6 O_2$, in the presence of oxidizing agents which take up two atoms of its hydrogen, becomes *Aldehyd* $C_4 H_4 O_2$. A similar action takes place when three atoms of chlorine replace in aldehyd as many of hydrogen, and the result *chloral* is represented by $C_4 (H_1 Cl_3) O_2$. Soubeiran, Leibig and Guthrie of N. Y., by distilling chloral mixed with lime and water, or with a solution of potassa, obtained a liquid which, when shaken with sulphuric acid, then separated and rectified over baryta in a perfectly dry retort, yielded *chloroform*; which is now more easily obtained by distilling a mixture of 1 lb. chloride of lime, 3 lbs. of water and 3 ounces of alcohol in a capacious retort.

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the composition of its name, chlor-al. This is a transparent, colorless liquid, of a greasy aspect; has an irritating odor, is quite tasteless, somewhat caustic in its action on the skin. It must be dropped into water and heated to effect its solution. If brought into contact with a few drops of water, a white crystalline solid is formed and heat is evolved.* Sometimes the term *Chloric Ether* is applied to the chloride of hydrocarbon, the *olefiant gas* of the Dutch chemists, and most probably the ether used by Dr. Priestman. Its formula is $C_2 (Cl_1) H_2$. Beyond their power of etherization, but little is known of the therapeutic properties of either of these so-called ethers, and their use, until further scientific investigations of their medical action, must be wholly empirical.

We may be permitted in closing this part of the discussion of remedies proposed, viewed or not from a Homœopathic stand-point; and after presenting thus crudely, the little that is known of the Morbid Anatomy revealed by the action of leading poisons upon the inferior creation; to state by way of apology for so imperfect a sketch, that it is designed mostly to show how much lies yet unexplored in this domain of provings in large doses upon domestic animals. We say *large* doses, and we mean, moreover, frequently—strenuously repeated; so as to enable the observer to compare the narrow range of symptoms, to which he must be confined from the inability of the subject to express its sensations, with the lesions revealed by the autopsy. In this way alone can we find a specific for any epizoötic; and we insist, that before any drug can make a fair claim for specificity, it should be shown to be capable of at least simulating the major part of the lesions as well as symptoms of the distemper to which it claims a therapeutic affinity. And until such or other more judicions experiments shall have been conducted to a successful issue, the veterinary art will be confined to its present system of palliatives. Every disease will run its course; and the issue of recovery or death will be determined by the balance between the germinal power of the poison absorbed, and the receptivity of the blood-fluid weakened, or recruited by empirical bungling.

We have yet in reserve, as before announced, the consideration of those remedies for which it has been claimed that they severally exercise a specific influence in arresting the peculiar ferment of the Pest. Incongruous as the list may seem, they admit of an easy and scientific classification, and may be arranged in three classes:

* Brande's Manual of Chemistry, p. 1305.

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1st. Those which are essential or concomitant elements of blood-food, and which may be exhibited to supply the waste of these elements during the progress of the distemper; these as opposing forces may be regarded as anti-catalytic.

2d. Those which may be supposed to set up a new ferment supplanting the morbid one, and thus act as apo-catalytics.

3d. Those generally known as antiseptics, which arrest the putrefactive process by rendering the fluid or tissues, in and on which the ferment is operating, incapable of putrescence, or even of fermentation, and are thus a-catalytic.

In this first class—as it is not our purpose to refer to those which are ordinarily embraced under the head of hygienic preparations, further than to say that Dr. Smart's method of preparing and exhibiting food for the sick animal meets every contingency which the most skillful and assiduous nursing could provide against—we will note a few instances, of which the most important is the *Chloride of Sodium*, or common salt. This chloride is found in the blood, gastric juice, urine, bone, cartilage,* &c. It exists also as a necessary element of vegetable food—seeds and grain containing the smallest amount, while green vegetables and meadow grasses (especially *Lolium perenne*, or common rye grass) hold it in largest proportion.† The common experience of those who are engaged in the rearing of domestic animals is familiar with the necessity of an artificial supply of this element of the blood, in order to obtain their highest perfection, to secure thrift in growth, or even the appearance of health. Boussingault's experiments are very happy and instructive. He took six oxen and divided them into two lots; to the one he gave salt at stated intervals, while he entirely refused it to the other. No perceptible difference in the appearance of these lots was, on the most careful scrutiny, manifest at the end of fourteen days; but at the close of the month it was revealed to the most unpracticed eye. In both lots the skin under touch was sound and fine; the hair of those to whom salt had been supplied was smooth and shining, of the others dull and staring. At the end of a year the hair of the second lot was matted, or *in places* had fallen out, and the animals were listless and inanimate, while the first lot had the sleek and fine coat of stall-fed beasts, and proved their high condition in frisky and rampant attitudes It seems strange on first thought to learn besides, that the supply of salt had exercised no influence on the quantity of flesh, fat, or,

* Simon's Chemistry, Vol. I., p. 2. † Liebig's Familiar Letters, p. 425.

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again in other trials, of milk obtained; but the marvel disappears when we understand that salt plays no part in the flesh-forming economy, but, according to Liebig, merely neutralises "the injurious action of the conditions which must be united in the unnatural state of animals fed or fattened in order to produce flesh."

A clearer statement is, that "salt serves in the organism to assist and promote the general changes without taking a share by its elements in the formative process."

It appears that a chemical action takes place in the system, by which chlorine (not found in chemical combination in any organized part or tissue, but ever present in every fluid of the body) leaves its base (sodium) in the common salt supplied to the animal, and unites with potash, forming the chloride of potassium; the soda set free uniting with carbonic acid, and forming the carbonate of soda.*

Time will not suffice to follow these changes as far as chemical and physiological research has carried them; it may suffice to add that the chlorine derived from salt, and uniting with the salts of potash, is found as a principal inorganic constituent of the muscles; that the soda as an oxide is found in the secretions of the liver; as a carbonate in the blood of the herbivora (although the ashes of their food yields hardly a trace of it), twice or thrice in excess of the carbonate of Potash;† while all excess of salt furnished is carried off rapidly in the secretion of the kidneys. It is important to note that the carbonate of soda (found also in the saliva) imparts to it as well as the blood their alkaline properties; that the tendency of this carbonate (as also that of potash) is to maintain the fluidity of the fibrine and albumen of the blood, that it assists in preserving the form and consistence of the blood corpuscles; and also performs an analogous function with reference to the other semi-solids of the body.‡

When we consider that all vital phenomena, or manifestations of those actions which take place in the body in a condition of health; though they may be said to be primarily dependent upon the organic nitrogenzied elements of the tissues or fluids for the

* Soda unites also with Oleic and Margaric Acids (the acids found in fat), forming the Oleate and Margarate of Soda, which are found in minute quantities in the blood, bile and urine, and with Pneumic Acid (the acid found in the lungs) forming Pneumate of Soda, which is not discharged from the body.

† In the milk of cows four and a half times (according to Berzelius), and six times (Pfaff and Schwartz) more than in human milk.

‡ Flint's Physiology, pp. 36 and 44; supporting Liebig's view, *ut sup.* p. 426.

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power of appropriating materials for their nourishment, or of self-regeneration to repair waste; are still, if secondarily, yet as essentially dependent upon the inorganic constituents of such tissues and fluids in order to keep up their play, and so maintain health and life; we find but little difficulty in concluding, that when any of the proximate principles, or elementary constituents, organic or inorganic, are in excess, or in deficient supply, their harmonious motions are disturbed, and the charm of vital play and healthy action is broken. The elements, which by too large supply in the first instance, or by the deficiency of their coördinates, and in the effort of nature to maintain a just equilibrium become so, must remain as clogs upon vital action, until they are thrown off, or agencies employed to restore the balance. And it is in this view that Liebig, in commenting on the condition of those animals which in the experiments of Boussingault were deprived of salt for a twelvemonth, is both convincing and eloquent, when he says that their bodies were, "in regard to disease, like a fireplace, heaped with most inflammable fuel, which only requires a spark in order to burst into flame and be consumed."

If the inquiry should now be deemed useless or visionary, whether those animals who succumbed so easily to the Pest had been denied or not a proper modicum of salt; or whether this agent was of any specific worth in the treatment of the murrains of the 17th and 18th centuries;* one conclusion will not be gainsaid, that in all future prophylactic and remedial treatment of the Pest, salt should be largely supplied in the food, and in the absence of other remedies might be relied upon as palliative if not curative.†

We shall embrace under the general division in which we have placed the chloride of sodium, two other agents, although we are far from insisting that either exists so largely as a constituent of the blood-elements, or has been traced as such; or that the latter has any existence in these elements except by conversion or as a product of disease. And in order that we may not give their consideration an undue prejudice, by reason of the classification we have previously made, we will for the present urge their disposal

* See page 304 of this Report, and note,

† As illustrative of the frequent agreement of the tentative experiences of instinct in our race, and the deliberate conclusions of men of science, it is not improper here to notice the fact that the Indians of this Continent, whose nomad life impelled them to the chase for the sustenance of life, and limited their supply of food to that mostly deficient in salt, should have used salt successfully as a cure for the bite of a rattlesnake. Sequal to 1st Report, p. 17. See also cases of cure by this agent, in Trans. of the Royal Soc., Vol. XII of Abridgment, p. 244; with white oak bark and vinegar, Vol. IX, p. 230.

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at this time as a matter of personal convenience; and with this apology we may be permitted to announce a summary view of the uses of *Oxalic and Acetic Acids* in the treatment of the Pest.

Oxalic acid is known to exist in vegetables eaten by man, as in the Rhubarb plant (*Rheum rhaponticum*), and in the Tomato (*Lycopersicum esculentum*).

It obtains also in vegetable food consumed by cattle, of which we will only specify the *sorrel* tribe, either the mountain variety, *oxyria reniformis* (R. Digynus L.), or the common Dock (*Rumex acetosa*), and the equally common *sagittate* plant. According to Liebig,* it exists in roots, barks and leaves to which cattle are frequently found to turn, leaving, when opportunity offers, their richer pastures for such relishes. True, the acid is found in nature mostly in combination with potash and lime. As produced by art, however, it is the only vegetable product which in its anhydrous form contains no hydrogen, and thus as the analogue of Carbonic Acid, deserves a careful study. The experiments made on animals by Christison and others, mostly by injections into the veins, exhibit its immediate control over the motor nerves evinced in walking with a peculiar stiff gait, in jerking or drooping of the head, and paroxysmal action of the muscles of the chest. The bright scarlet spots, observed by Smart, are brought out on the external surface of the lungs, unless death has been very rapid. Though no reliable deduction can be made from these injections into the venous trunks, whether femoral or jugular, yet the *post-mortem* appearance in men who have been poisoned with this acid taken into the stomach show the same reddened (sometimes brownish red) appearances of the mouth, gullet and windpipe (stomach in parts black, in parts red), duodenum and jejunum; with easy detachment of the epithelium and villous coat, as in the Pest. The high affinity this acid has for lime and potash might justify its use, as a chemico-physiological experiment, at the period when there was reason to believe that the bases of these salts were passing off in the general disintegration of the blood-fluids. It could only be exhibited in dilute form in small doses, frequently repeated, as in a concentrated solution it rapidly destroys the coats of the stomach, inducing gangrene—or affecting the brain by sympathy—convulsions and rapid dissolution. But we only design to indicate it to be worthy of provings such as we have previously suggested—with the caution applicable alike to most acids and corrosive drugs—that in its

* Animal Chemistry, p. 58.

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administrative trials every effort should be made to avoid as far as possible those local lesions in the digestive canal, which induce death before the general constitutional disturbance is produced; for it is this alone which it is of importance carefully to study, both in the consequent changes induced in the lining or enveloping tissues of the principal organs, in their substance, and in that of the fluids of the body.

Acidum aceticum (*radical vinegar*, as it was formerly called,) may prove of more value than any other acid in this disease, and, if so, is of ready use in domestic vinegar. By doses of four tablespoonfuls a day of the latter given to adults, Dr. Parrot, of Dorpat, Russia, successfully treated many cases of epidemic typhus in 1812, and this where the fever was accompanied with obstinate diarrhœa. In this latter symptom its use is always admirable.

Dr. Thomson says that it has been administered in combination with *salt* in dysentery, checking the purging and correcting the fœtor of the stools.*

Its existence in the sweat has been shown by Thenard, and when the acid is combined with a base, the addition of the perchloride of iron to a solution of the salt produces a deep blood-red color, an effect not observed when the free acid is alone employed.†

In this view, as well as of the combination commended by Dr. Thomson, its use would be more efficacious in a Zymotic when saturated with salt, the compound to be administered largely diluted with water.

It may be also urged that this acid represents chemically the fruit acids—at least the one most common in this climate and country—*Malic Acid.* Liebig regards all the organic acids as having an analogous constitution, and deems it "the most natural supposition that they contain in each case a compound radical, of which Hydrogen is an element; in such a manner *therefore* that the conversion of Carbonic Acid into an organic acid has been effected by the replacement of a part or of the whole of the oxygen of the radical, by hydrogen."

In this way, and on this supposition, he makes the formulæ of Acetic and Malic Acids the same, and adds:

* Materia Medica, Vol. II., p. 56. In the presence of the more fashionable remedies of the age, this has almost passed into oblivion as an efficient agent in Phthisis, for which Galen prescribed it and Oriental physicians now use it. In the form of vinegar its use is mostly confined to domestic cooking, unless when some young female, ashamed of her obesity, uses it so freely as to induce hæmoptysis and consumption.

† Simon's Chemistry, Vol. I., p. 86.

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"It is easy to see that the formulæ of Acetic and Malic Acids correspond to that of Oxalic Acid (only being doubled), and that Tartaric Acid is Carbonic Acid, in which half the oxygen of the radical has been replaced by hydrogen, while one-fourth of the oxygen external to the radical has been separated or expelled without replacement."*

It is not to be inferred, however, that the chemical theory of equivalents as thus expressed, is to serve as a foundation for equivalent medical action; or that any such experience as is found in the laboratory would be repeated in the stomach of either man or beast. But the manipulations and conclusions of the chemist may serve as our sufficient authority for introducing these acids under the general classification and at the point we proposed at first on the grounds of convenience.

And here it may meet a scientific requirement, to bring to notice other primordial elements of blood-food. In such way this branch of our inquiry may take to itself a more perfect unity. We have cited common salt as the representative of the mineral constituents of the animal economy. We might, had our limits permitted, also have adduced the salts of potash and lime; of which nitre and the iodide and chlorate of potash and the phosphite of lime are the representatives in medical practice now most commonly in use. But of the non-mineral constituents, it is understood that the carbonaceous element of the animal frame (through vegetables) is derived from *Carbonic Acid*, two of whose analogues, as therapeutic agents, we have adverted to; that the non-nitrogenized element (as in sugar, starch, oils, &c.) derives its hydrogen from *water;* while the nitrogenized elements (as in muscle, gluten, &c.) take their nitrogen from *Ammonia.*

But as the uses of water are well known, and we have previously expressed our views as to the value of ammonia as a medicinal agent, we may be considered as having sufficiently dwelt upon the typal

* Animal Chemistry, p. 68, Amer'n (3d London) edition. The formulæ are as follows:

Carbonic acid, $C_2 \left.\begin{matrix} O \\ O \end{matrix}\right\} + O_2 = 2R + 2O.$

Oxalic acid, $C_2 \left.\begin{matrix} O \\ O \end{matrix}\right\} + O = 2R + O.$

Malic acid, $C_4 \left.\begin{matrix} H_2 \\ O_2 \end{matrix}\right\} + O_2 = 4R + 2O.$

Acetic acid, $C_4 \left.\begin{matrix} H_2 \\ O \end{matrix}\right\} + O_2 = 4R + 2O.$

Tartaric acid, $C_4 \left.\begin{matrix} H_2 \\ O_2 \end{matrix}\right\} + O_2 = 4R + 3O.$

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forms of blood-food, and may pass to the second class, of those for which the claim has been made, of specificity in the Pest.

On this class, the one which embraces antagonistic ferments, we shall not dwell long; as we will not undertake to discuss and do not care even to point to those which in putrescent cheese or meat (as in badly prepared Bologna sausage), when introduced into the human stomach, have produced such subversion of the natural fermenting power of that organ and its adjuncts, as in many instances to baffle all medical skill.

It is our purpose to treat in this class only of *yeast*, which, as we have seen (p. 344), has been said to have been successfully tried as a remedy for the Pest; and our view of it as a remedy will be chiefly by way of comparison.

Yeast deports itself in the presence of many agents and re-agents, as the ferments of zymotic disease are believed to do, and may in this respect be regarded as their type. As familiar as the common mind is with this substance, its scientific definition may not find such ready discernment. It is a compound of nitrogen in the state of putrefaction or erèmacausis (slow combustion or decay), possessing the power of causing fermentation in sugar or non-nitrogenized organic bodies, of which sugar and starch are the commonest instances, and carbon the chief constituent. The presence of water is necessary to sustain its power of exciting ferment, and this is lost under pressure, or when the yeast is desiccated and dried.

It is alone its soluble part, however, that possesses the property of inducing fermentation, and this only after it has received oxygen from the atmosphere, to which it must be first exposed. It then develops in its mass carbonic acid. Like vaccine or purulent matter—if not kept dry too long, and under attendant circumstances which ensure its own decomposition—when again moistened it starts afresh on its destructive mission.

The fermenting process is easily carried forward to putrefaction in bodies containing nitrogen, of which, in the animal organism, blood is the *primum mobile*. And as nitrogen has so low an affinity for the simple bodies that it is said to be in a state of indifference to them, its evolution is always attended with an easy transposition of atoms. When acted on by alkalies, by acids, or increase of temperature, organic compounds containing nitrogen in the presence of water throw off all that element in the form of nitrates; but if the azotized animal matter first moistened be exposed to the action of the oxygen in the atmosphere, then in the form of

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ammonia. When gluten, the vegetable equivalent of albumen, is subject to the putrefactive process, after the evolution of carbonic acid and hydrogen commences, the ammonia takes on its forms of phosphate, acetate, caseate and lactate, which are produced in large quantities, so that for the time being the decomposition of the gluten ceases; but if water is freshly added the process is renewed, and then, in addition to the products just mentioned, we have carbonate and hydrosulphate of ammonia and a mucilaginous substance coagulable by chlorine, &c. Those who desire to follow the labyrinthine changes of which nitrogen is capable, will find that subject elaborately treated by Liebig,* from whom we have freely taken the views above expressed. We must turn, however, to the brief consideration of the agencies by which fermentation is arrested.

These are embraced in a long catalogue known as antiseptics, of which we may mention the most important; to wit, boiling water, alcohol, salt, an excess of sugar, the mercurial salts, nitrate of silver, volatile oils; the mineral, pyroligneous, sulphurous and carbolic acids.

"Alcohol and common salt, in certain proportions, check also all putrefaction, and consequently all processes of fermentation; because by these means the putrefying body is deprived of a certain condition of its decomposition, namely, the presence of a certain quantity of water."

The action of these antiseptics, in arresting yeast ferment, and also the putrefactive process in animal substances, is of the highest interest in the pathology and treatment of zymotic disease, and will readily furnish to the enthusiastic student of medicine most valuable suggestions. His aim in their applications in medical and veterinary practice, will be to select such as will produce the least disturbance, transient or permanent, on the vital force. We will only add, that from the similarity of the action, while in the state of propagation, of yeast and morbid poisons, and the identity of the means by which it may be arrested, that it is not improbable that yeast may exert a curative action in the Pest; though even such probability requires that more numerous trials should be successfully instituted than those previously noted.

The old school of medicine has long since exhausted its ingenuity in the use of mercurial salts and the like, in the treatment of epidemics, and has passed from the general use of the mineral acids;

* Ag. Chemistry, p. 282 et seq.

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and the present school rejoices in the discovery of the efficacy of those last named in our list, to wit, sulphurous and carbolic acids.

This brings us to the consideration of two of the most valuable antiseptic remedies; which are embraced in our third division of specific agencies.

The farmer has long been familiar with the fact, that if he burns a little sulphur in a barrel which has been rinsed out with water, and confines the fumes produced, so that they are absorbed by the wet surface of the staves; the cider he may subsequently pour into the vessel, will remain sweet for a long period and will not undergo the fermentation ordinarily induced. This preserving power is one of the attributes of the *sulphurous* (not sulphuric) *acid* generated in the combustion of sulphur, and has been taken as the starting point for some exceedingly ingenious researches by Dr. A. Polli, of Milan. This learned professor adopted the catalytic theory of disease, as applicable to those maladies in which the blood having absorbed some poisonous morbific germs, undergoes marked constitutional changes; and though he was met at the threshold of his investigation by the dogmatic assertion of the celebrated Bernard, that any substance capable of destroying a catalytic poison in the blood, would so affect that fluid, that it would be thereafter incapable of vital function; persisted in his inquiries, until he satisfied himself that not only did sulphurous acid possess this power, but that its compounds with soda, lime, or magnesia whether hyposulphites, simple sulphites, or bi-sulphites also exercised the same function, and could be exhibited in large doses and with perfect impunity. Two animals of the same kind, size, and condition, and fed alike for a few days, except that one received a certain amount of a sulphite in his food, were slaughtered; when it was discovered that the latter gave evidence of the existence of the drug in every tissue, organ, and secretion; and furthermore, remained perfectly fresh though the weather was that of summer in a tropical clime; while the former, to which no sulphite had been given, rapidly passed after death into an advanced stage of decomposition. This experiment being confirmed by many others equally satisfactory, the deduction naturally followed, that as no fermentation could exist in the presence of a sulphite, and as this remedy could be administered without any injury to the vital function, and permeate every part of the living structure, that it was only necessary to saturate the system with a sulphite, in order either to prevent, or arrest the catalytic action in all zymotic maladies.

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But further to establish this deduction by facts, the Professor next selected two dogs of equal size and weight, and in perfect health, fed and treated them alike for four or five days, except that to one was administered a certain quantity of the bi-sulphite of soda. Some very fœtid pus, obtained from an ill-conditioned ulcer, was then injected into the femoral veins of each dog (about a drachm to each), the experiment being repeated the next day. After the first operation both laid down, refused food and remained prostrated for twenty-four hours. The effect of the second injection was more marked. They were seized with stupor, their pulses were rapid and feeble, and their respiration greatly accelerated; when made to rise they tottered and reeled across the room. The one to whom the bi-sulphite had not been given grew worse, his wound in the thigh became gangrenous, and in ten days he died with all the symptoms of typhus; while by that time the other, receiving his daily dose, and having regained in four days his appetite, was entirely well.

Like experiments have been conducted in a vast number of cases by the Professor and his compeer, Dr. De Ricci; sanious matter from ill-conditioned and phagedenic sores—defibrinated blood exposed to the air until it has become putrid—the discharge from the nostrils of glandered horses—have been employed, and in all cases proved fatal without, and wholly innocuous with, the concomitant use of the sulphites. Conversely, De Ricci has exhibited the bi-sulphite in an alarming case of septicæmia—produced by a lady's kissing the lips and face of a dear friend who had died very suddenly—giving nearly twenty grains of the bi-sulphite in infusion of quassia, &c., every half-hour at first and then every hour, and with the most perfect success. Since that time the use of the sulphites has been extended to cases of scarlatina, measles, phlebitis (originating from the stinging of the back of the hand by the spines of a cactus), the malignant epidemics of the Northern Coast of Africa, puerperal fevers, &c.*

In most if not all these diseases, the administration of the sulphites has also proved *prophylactic*.

When the fermenting process is arrested by sulphurous acid, the rationale of such action, according to Liebig, is that atoms of oxygen are taken up from the liquor of ferment, and combining with those of the sulphurous acid, form *Sulphuric Acid*. If this

* Dublin Quart. Journal, August, 1864; Glasgow Medical Journal, October, 1865.

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transposition in inorganic, is also realized in organic fluids, and takes place during the administration of the sulphites in zymotic diseases; the resultant acid being formed in very minute quantities and generally distributed throughout the circulating media, could not exert its ordinary local effects, which are primarily escharotic and destructive of the tissues. Indeed, Pereira's statements in regard to the constitutional action of all mineral acids may be adopted here, that they become neutralized by combination with bases (of salts), and are not absorbed as free acids which operate topically only. In this view we may be spared any extended discussion of the constitutional disturbances produced by the use of sulphuric acid; and for the further reason that its lesions do not correspond with those of the Pest.

The *Sulphite of Potassium* develops in the treatment of zymotics, action equally beneficial with that of the like salt of soda. It is more expensive, and for that reason not so well fitted for general use. Nevertheless, it should be employed as we may recommend in experimental trials; and in all desperate and long neglected cases, where it is probable that the salts of potash have begun to leave the circulation.

Carbolic Acid, sometimes called *Phenic Acid*, but chemically, *Phenic Alcohol*, or *Phenol*, is said to occur as a natural product in the secretion of the beaver, *castoreum*, whose peculiar odor is that of this acid; it is also found in the oil of *coal-tar*. Its aqueous solution has an acrid taste, and an odor like that of wood smoke or creosote, of which last it is probably a homologue.* Its formula is $C_{12} H_6 O_2$. It is obtained by the decomposition of *Salicylic* Acid† (an acid of the benzoic group), which is itself derived from several species of *Salix* (willow), and from the flowers of *Spiræa ulmaria* (queen of the meadow). As it is highly poisonous, it is to be administered with discretion, and largely diluted with water. In this form it is very valuable as an application to the skin, where wounds and sores reach a putrescent stage,‡ and like the sulphite of soda, thus dissolved, is readily absorbed. The latter so diluted

* Silliman's Chemistry (Organic by Hunt), § 789.

† The common *wintergreen* (*Gaultheria procumbens*), contains in its essential oil the ether of this acid—to which, or the oil of wintergreen, if strong nitric acid be added and the mixture boiled as long as red vapors appear, *trinitric phenol* (*nitropicric acid*), is obtained on cooling. Ib., § 795.

‡ Also in the treatment of compound fractures of bones and in burns, as recommended by Prof. Lister; and in the treatment of burns of the first and second degree, by Prof. Pirrie, &c.

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and applied with a wet bandage, we have known to discuss the formation of ordinary boils; the former of erysipelatous swellings. Whether this acid will act as readily or more effectually in arresting the Pest-ferment than sulphurous acid, in its administration through the sulphites, time and experimental trials will best determine.

As we have progressed (though wearily, we fear, to some of our readers) in this extended review of the potential action of remedies propounded by various authorities as available in the cure of the Pest; some light has been incidentally thrown (as we imagine) upon the pathological course of this distemper. We have seen the important and curious part which the chloride of sodium plays in the animal economy (p. 360) in the preservation of its equilibrium, or what we ordinarily term the state of health. Inferentially we are able to approximate at least to the nature and order of those disturbances which must take place, when this essential element of the fluids and semi-solids of the body is withheld in times of scarcity, or through neglect to supply it at stated intervals; or when, in the progress of the fermenting processes of disease, it is decomposed or forced out of the circulation. Then its normal function must be deemed to be wholly negatived; especially, we conclude that the fluidity of the fibrinous and albuminous elements of the blood, and the form and consistence of the blood corpuscles, are impaired.

At such a juncture (though science may not as yet have demonstrated the order of the successive stages) we may also infer that the transposition of the atoms of nitrogen, which in their allotropic forms make blood, fibrine, &c., commences; the probability being that they take their departure in the form of ammonia, and that some of those subsequent combinations are formed in the body, which have been previously sketched (p. 365).

We can thus see how the secretions, not as in cholera, largely made up from watery constituents, but surcharged with alkaline carbonates, are poured out upon the mucous surfaces, with excoriating power; bringing with them the first products of decomposed nitrogenized matter, to be in their turn fresh elements of corruption, if communicated to other animals; or, if reabsorbed, additional exciters of the putrid fermentation. And we can readily infer, that when the bases (salt, potash, &c.,), of the inorganic constituents are withdrawn from the circulating media in certain measure, the ferment of the organic elements reaches the stage where putrid exha-

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lations, the evidence of their accelerated decomposition, are first the harbingers and then the accompaniment of death.

But as in organized structures we have not only to consider the play of elementary bodies, such as are reproduced in the laboratory, and thus display the chemical laws to which they are subject; but also the power, countervailing doubtless in many ways, which vitalized membranes and structures exert in limiting or enlarging such laws; and also that mysterious agency lying behind all possible phenomena, the *vis vitæ* itself: so the views we have just advanced on the function of the saline constituents of the blood, and its easy disintegration in their absence, total or partial, need further elucidation in the light thrown by physiological research on such topics. We can only glance at one or two illustrations.

The mineral acids have been generally regarded (p. 366) as antiseptic agents. But they exert their power in various degrees of manifestation, and do not all deport themselves as pure chemical solvents. In some cases they can hardly be said to exert any direct, if any influence whatever, on the fermenting fluid. Take, for instance, arsenious acid (common arsenic). Its action is wholly confined to the membranes and membranous tissues with which it is brought in contact. It does not exert the slightest influence, according to Liebig,* on the fermentation of sugar in vegetable juices, the action of yeast on sugar, or even the putrefaction of the blood; its scope of action on the tissues being explained by the fact that the gelatinous tissues form a combination with this acid, similar to that which tannic acid forms with the skin. The prudential use to be made of this discovery of the chemist, and as corroborating what has been previously advanced (p. 352), is that this acid has no relation to the Pest; and that neither this nor any other acid should be employed in the treatment of any zymotic, whose force is expended in part or in whole on the membranes with which it is brought in contact, unless it has the further peculiarity of ensuring for, or restoring to them a more active power of absorption.

But a more pertinent illustration is to be drawn from the behavior of common salt in the phenomena first observed by Dutrochet, when exploring the mutual action of two liquids on each other through a membrane. This action was named by him and is now generally known as *endosmose*.

* Animal Chemistry, p. 136.

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If a glass tube about six inches long and with an aperture of one-quarter of an inch, be covered at one end with a piece of fresh membrane, taken from an intestine, bladder or stomach; and after being filled with a solution of salt, is held in a vessel containing pure water, so that the level of the two fluids is the same: in a short time there will be perceived an elevation of that contained in the tube, which is to be regarded as the result of a force exerted against the law of gravitation, and at its height is equivalent to and may be measured by a column of mercury two or three inches in height.

If to the water in the vessel there be added salt enough to make it of the same saline strength as that in the tube; in an equally short time, the fluid in the latter will go back to its original level. But if again, more salt be dissolved in the vessel, the fluid in the tube will soon be found at a lower point. The law of these changes of level may be thus expressed.

"The spring water flows towards the saline water, and the weaker solution of salt towards the stronger; as if forced by an external pressure to pass through the pores of the membrane, in opposition to the law of gravitation."*

Water also flows towards *blood*, when into the tube is poured ox-blood, deprived of its fibrine, and the experiment is conducted in the presence of water *heated* to blood heat or 100° Fahr. But this flow is dependent upon the existence of salt in the *liquor sanguinis*.

If again to either fluid, as in the original experiments, there be added a free alkali (carbonate or phosphate), the change in level is more rapidly produced. And finally, if the outer liquid be made slightly acid, then "the flow of the acid to the alkaline liquid takes place with the greatest velocity." The philosophy of digestion in the flow of the alkaline fluids of the blood toward the stomach, which, when distended with food, secretes an acid, and the general percolation of fluids through the membranes of the body find an easy illustration in these experiments. The latter may also explain how an acid judiciously selected and employed so as not to impair the susceptibility of the membranes, may be so moved by the swift propulsion of osmose, as not only to neutralize the alkali in excess, but also to arrest the attendant decomposition. But aside from such conjectural views, we have at this time a practical purpose in

* Liebig's Letters, p. 430.

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drawing attention to the action of saline drugs. When these are introduced into the alimentary canal, to induce catharsis, the flow of fluids not so highly charged with saline ingredients—as in the experiment with the glass tube, covered with membrane—is toward the more concentrated solutions; and the bowels thus distended soon relieve themselves by purging. A moment's reflection leads to the conclusion, that as by this operation the circulation has been deprived more rapidly of its saline constituents than it would have been by the force of the disease, the latter has received fresh augmentation of its power, and not the amelioration of condition anticipated. Another deduction and we have done. Salines introduced even indirectly into the circulation to repair waste, should never be in a concentrated, but a highly dilute solution; as it is only in this way we can institute an endosmosal current by which they may be carried into the circulating media, and reverse the morbid current which tends to carry them out.

We are now in a position where we may essay what we have proposed, and propound a method of treatment that may best accomplish cure. We would gladly avoid the responsibility which must always attend the proffers of those who challenge an untried enemy. But if we are clothed in the armor of science, and avail ourselves of the promptings of a wise instinct inspired by her teachings and instructed by the errors of those who have preceded us, we can hardly fail. If we should, however, we are satisfied that thus we will prepare the way for more successful overtures in future.

We trust, however, that we may not be ranked with those who have at first counted without their host, or at the last, made false alliances. We do not propose to shield our methods under any special theory, however fashionable. We will not espouse all the conclusions of the chemico-physiologist, to the disgust of the humoro-pathologist, or the disciples of the vital school. We "take the good the gods provide" us. We essay only a common-sense solution of the foremost intricacies in the problem before us; and will be content, if we succeed thus far, to leave what remains to the fancy or skill of the theorists of all creeds. But that we may not seem to be trifling with the honored and well earned confidence which the teachings of the different schools have inspired, we interpose an explanation. If one were bitten by a rattlesnake, it would be held by men of ordinary judgment to be the most reprehensible bravado in him, to refuse all the methods of relief proposed, and

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to trust entirely to the peculiar strength of his constitution to quell the poisonous invasion. And it would present a temerity entitled to but little less of blame, if he were wittingly to allow the poison, "swift as quicksilver," to course through—

> "The natural gates and alleys of the body
> . . . . . posset,
> And curd like eager droppings into milk
> The thin and wholesome blood;"

—that at the last he might either prove himself in possession of a talismanic charm, strong enough to foil its enmity; or by a succession of charlatan-remedies to baffle his antagonist, or by countermoves, to weary him out. The instinct, or if you will, the common sense of the race, demands that no dalliance be held with such a mortal foe. The bane must receive its antidote, if to be found, and that without a moment's unnecessary delay.

In this view, the end proposed is to act as if the Pest germs were the poison of an asp, at once to be rendered inert; or some baleful dose swallowed, whose corrosive action is instantly to be neutralized. The first and great point then is to get rid of the toxic effects of the poisoned germs which are developed in this zymotic, and to this end, if one may qoute a homely but expressive proverb, "not to let grass grow under our feet."

As a guide to the unskillful—a hand-book also to the learned—we will indicate our proposed method of treatment in a series of rules.

RULE I.—In apprehension or in the presence of an outbreak of the pest,

a. Apply the thermometer (see p. 312) to the vulva or rectum; and if the heat of the parts (the females not being in a state of sexual excitement, and none overheated by driving, &c.) rises to 102° Fahr.; or—

b. If no such instrument can be readily had or reliably used; observe the appearances of the inner mouth (see p. 320). If to the eye or by the aid of a magnifying glass there appear small round nodules (knobs) no larger than a millet seed, red at the point or head, or some of them broken and discharging a yellowish or yellowish-grey matter,

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and the thin membrane which covered the swelling and those adjoining peeled or rolling off:*

All animals exhibiting these signs are at once to be put under treatment as in Rules, II, &c.

RULE II.—*a.* Let all such animals be *separated* at once from the herd, and placed in an out-building which is to be used as a *hospital*—in suitable stalls or boxes—from which all hay, grass, straw, litter, loose dirt, cobwebs, &c., are to be removed. Sawdust, tan-bark, or dry sand is to be their bed.

b. Dissolve 2 oz. of *Sulphite* (not sulphate, which is Glauber's salts) of *Soda*, or 1 oz. of the *Bi-sulphite* in 12 quarts of pure spring or clear rain water.

(If the treatment of the case has been long deferred, or the outbreak be deemed an alarming one, double the quantity of the salt may be employed, not otherwise.) Administer one pint of this solution every hour (or half hour), after Gamgee's plan.† A tin twisted cup in the shape of a horn, with its mouth well rounded off, is to be employed to the *exclusion* of glass bottles. "The operator should go up to the right side of the animal, pass his hand over the face into the angle of the mouth in the left side. The head is bent round, not elevated, except to a slight extent; . . . . the person giving the draught to plant his feet well on the ground, with his back against the animal's shoulder, ... and holding the horn in his right hand, pour its contents by degrees into the animal's mouth."

c. Take one-half (6 qts.) of the solution as above, and add to it 12 qts. of warm water (120° Fahr.), so that the mixture when used may be at least ten degrees above blood heat.‡ Take a coarse cotton

* Those who apply the thermometer in time will SAVE THE WHOLE PERIOD OF INCUBATION, or at least *five days* of *burrowing* of the pest-germs through the membranous tissues, and of their ferment in the fluids of the body. Those who watch the first signs in the mouth may save from *two* to *four* days. Those who are so indolent or inobservant, as to wait until they find the disease in full blow, should "go farther and fare worse." Let them hunt up other indications which may serve to alarm them. We have no patience for such a task.

† Cattle Plague, p. 98.

‡ This temperature will meet the requirement of the fourth law of absorption by osmose as laid down by Matteucci in his fourth Lecture on the Physical Phenomena of Living Beings.—Am. Ed., p. 89. See also p. 372 of this report.

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sheet folded to four thicknesses, and wetting it with this warm solution (wringing the edges of the folds so that the water will not drip), lay it on the middle of a coarse woolen blanket (previously fitted as to size, and with straps to fasten it, &c.); then apply to the abdomen and fasten the blanket over the back. (Apertures may be made in the blanket if long enough, so that the hind as well as the fore legs may not be restricted in their motions, and so as to protect the chest and buttocks from the air.)*

d. If no Sulphite or Bi-Sulphite of Soda can be procured, *or more than one* animal is to be treated, use *Carbolic Acid*, 4 drachms to 12 quarts, pursuing the same method of internal as well as external treatment as in (*b* and *c*).

e. For *like* reasons as in last rule, employ 1 oz. of *Aqua Ammonia* to 12 quarts of water, as in (*b* and *c*), or,

f. 1 pint of alcohol with as much salt as it will hold in solution as in (*b* and *c*), or,

g. 1½ quarts of vinegar saturated with salt as in (*b* and *c*), or

h. Other remedies, the specificity of which is to be proved by the same methods.

i. As an independent experiment with the sulphite of soda (or if the sulphite of potassium can be had, with it also), 20 gr. powders might be thrown every hour under the tongue, to be dissolved in the saliva which is rapidly secreted and then to be swallowed.

RULE III.—If the symptoms do not indicate that the ferment has subsided, twelve hours after the medicinal draughts as prepared have been entirely taken, or if they recur, commence anew with a fresh portion of the remedy selected, and proceed as in Rule II (*b* and *c*).

* As the object of this application is to induce endosmose of the saline solution by the abdominal organs, and *not* a general perspiration, the blanket must not be too tightly secured.

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RULE IV.—*a.* If nervous twitchings or the like make their appearance, apply pounded ice in a bladder or bag, to the base of the brain and the spinal cord (from between the horns for a few inches along the neck.) If this application does not soon relieve, and the Homœopathic treatment is preferred, in the choice of intercurrent between the doses of the antiseptic remedies, as above to be employed; give 10 drops of the tinct. of Belladonna in four tablespoonsfuls of water, or if the Allopathic methods are chosen, and *diarrhœa* has supervened, add a tablespoonful of laudanum* to a pint of starch emulsion (or warm water) and inject as an enema into the rectum.

b. If after twelve hours from the commencement of the treatment, symptoms of aggravation appear, the dose may be doubled. Otherwise if evidence of improvement appears, it may be less in quantity and given at longer intervals.

c. When it appears desirable to remove the bandage from the bowels, the portion of the body wet by it may be gently dashed with water from the well (60°–70° Fahr.), then rubbed perfectly dry, and the body covered with a fresh blanket so as to exclude the action of cool air.

d. If the bandage is not used, still the animal is to be covered with a blanket, and the temperature of the stall kept not lower than 60° Fahr. If the covering is sufficient, fresh air may be more freely admitted.

*It would be useless to give morphia or opium in any of its forms, while a medicinal endosmose is being instituted—as it is well known that these first check and then reverse the process (see Matteucci's Lectures, p. 79). They can be exhibited only when the morbid osmose has filled the bowels and brought on diarrhœa. If the brain conditions indicate the use of opium in coma, stertorous breathing, and upturned eye and contracted pupil (or a pinched eye), a warm solution should be applied and rubbed in, along the face or the under part of the neck, or one-half of a grain of morphine, or 5 grains of first decimal Homœopathic trituration may be thrown in under the tongue. It will be readily admitted as unwise, in the present state of our knowledge, to hope for alleviation of symptoms by putting opium in any of its forms, in the stomachs, while they are in a state of suspended activity. Otherwise we admit, if scientific experiments could show that when the normal endosmosal current towards the stomachs had completely ceased, opium could exert an antagonistic power, and renew the current.

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RULE V.—*a.* When the patient gives signs of hunger, dilute milk or boiled gruels (as in Smart's method, p. 336), to which a free allowance of salt has been added; or when thirst is manifest, water from which all chill has been taken, may be given a half hour before the administration of the medicine.

b. Should any unpleasant odors arise from the body, breath or droppings, dilute sulphuric acid may be added to a small portion of chloride of lime, and after the early escape of chlorine, and when the caustic smell of lime is perceived, the vessel is to be removed; and the contents, added to the droppings of the sick beasts, also to be removed, and covered with six inches of earth. Or carbolic acid may be used in dilute solution, and the sides and floor of the building sprinkled with it. And so with any disinfectant, such as carbolate of lime, sulphate of iron, dissolved in water, &c. Carbolic acid may be dissipated through the building by throwing from time to time a few grains of it upon a hot plate—dipped for a few minutes in boiling water and then wiped dry.

c. If constipation show itself so as manifestly to make the animal uncomfortable (and not otherwise), give two quarts of an injection of blood warm water, to which a couple of tablespoonsful of salt have been added.

d. Should any disposition to swelling (emphysema) show itself along the back from the beginning, make the wet bandage large enough to go around the trunk; if it be only partial, or occur at a late period, shift the bandage, &c.

e. If any viscid or glairy secretions from the eyes, nose, mouth or vulva begin to flow, the parts are to be frequently bathed with a weak solution of carbolic acid, or with vinegar to which an equal portion of water has been added.

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Rule VI.—The *sequelæ* of the disease must be treated according to *their indications.** If the medicines have not been pressed with too much activity, there need be but little apprehension of any violent reaction on their use. And if no such reaction manifests itself, the animal is *best left* to the "*vis medicatrix naturæ.*

Rule VII.—*a.* When convalescence is established, the diet as given by Smart may be followed. Before being admitted to the herd, the patient should be carefully washed with a weak solution of carbolic acid, into a stronger solution of which the feet first washed out in the clefts very carefully have been allowed to stand for a time. After this operation a quarantine of seven days would be advisable.

b. To cleanse the premises *boiling* water may be sprinkled frequently and copiously over the stalls, floors, &c. If cold water is employed, the common washing soda of the shops should be added, and all boards, &c., carefully scrubbed. The clothing of attendants may be treated in either of the above ways, or may be washed with water to which carbolic acid has been added, or they may be hung up in a barrel, and sulphur slowly burned under them, &c.

This method of treatment will, we trust, be received by candid minds as fulfilling our pledge, not to commit it obsequiously to the interest or dogmas of any school. It will be doubless considered in this respect sufficiently catholic. In the variety of agencies offered in Rule II, opportunity is offered to determine experimentally which is most efficacious. If the so-called antiseptic remedies prove their superior virtue, they will furnish additional proof that this zymotic acts as a true ferment. If *ammonium causticum* takes the lead, it will afford another illustration of the Homœopathic law. If the absorption through the wet bandage (and we would like to see isolated trials of this method), should work successfully,

* The constitutional disturbances produced by the force of the disease—perhaps also by the remedies—may require further medical treatment. This must be determined according to the preferences of the practitioner and the methods of the school to which he belongs. The foregoing pages may prove a sufficient guide to indicate which medicines in especial contingencies cure the case most completely.

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this would draw just attention to the practicable adaptation in disease of the law of endosmose, and would ameliorate the heroic use of the water treatment.

In conclusion, whichever of these remedial methods should give the greatest percentage of cures, would best indicate the selection of a prophylactic agent; though we imagine that even the use of this would not excuse the farmer or stock grower who did not, in the presence of this epizöotic, give to his cattle at least their ordinary quota of salt, as often as twice a week.

P. S.—Thanks are due and very cordially expressed to Alonzo H. Clark, M. D., of New York, for access to the plates, &c. of Perigoff; to S. O. Vanderpoel, M. D., and E. P. Hun, M. D., of Albany, for the studies of Lebert and Cruveilhier; to Samuel Lilienthal, M. D., of New York, for translations from Jessen; to John L. Vandervoort, M. D., Librarian of the New York Hospital, for transcriptions from Rammazini and Lancisi; and to the Committee of the New York Medical Society, of which D. D. Smith, M. D., is Chairman, for marked courtesy and very valuable suggestions. It is not to be inferred, however, that either of the above named gentlemen, celebrated for their mastery of Pathology and Therapeutics, are committed to any of the conclusions in this report. These, hastily sketched in intervals of leisure, must stand as the independent conclusions of the writer, and as they have been put forth with much diffidence, a kindly criticism is solicited for them.

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APPENDIX,

Giving the descriptions of symptoms, and post mortem appearances, &c., of the epizootic of 1711, *as described by Rammazini and Lancisi; as in the original text.*

Symptomata—Rammazini, p. 787.

"Affectiones genus, quod Bubulo generi bellum ad internecionem usque videtur indixisse, ex frigore, rigore, *horripilatione*, mox ex calore acri, et vehementi per universum Corpus diffuso, cum pulsus frequentia, febrem esse satis liquet, malignam vero, exitialem, pestilentialem etiam, si mavis, esse aperte testantur, quæ illam comitantur symptomata; qualia sunt, magna anxietas, et *gravis anhelitus*, etiam cum stertore, et in principio febris, stupor et species quædam veterni, continuus ex ore, et naribus *graveolentis materiæ descensus*, fœtidissima alvi proluvies, interdum etiam cruenta, anorexia, et abolita penitus ruminatio, *pustulæ* quinta vel sexta die per *totum corpus* erumpentes, ac *tubercula* variolarum speciem referentia, communis tandem omnium eodem modo circa quintam, et septimam interritus, cum Boves paucissimi evadent, iique forte potius quadam, quam remediorum dynami. Hæc quidem ex se patent, quid vero intus patiantur miserandi Boves, cum jacent anxii, ac stertentes, ac dum stant immoti, capite usque ad terram demissio, conjec tare quidam possumus, sed ex mutis animantibus, quæ per nutus nihil significare possunt, nil certi rescire possumus, quod forsan in causa est, ut difficillior sit curatio. Causam igitur hujusce malignæ febris pro viribus perscrutemur.

Omnibus epidemiis, si a sporadicis affectibus differe debent, id peculiare inest, quod communem causam habeant, sive ab Aëris vitio, sive a corruptis alimentis, aut ab aliquo contagioso fomite prognata fuerit, qui ab uno corpore in aliud transmigret illique eandem labem communicet."

Observatum in Dissectis Cadaveribus, p. 791.

"In Boum cadaveribus, quotquot Lanionum secespitæ subjecta fuere coram Excellentissimis Anatomes Professoribus *D. Molinetto.* et *Viscardo*, id singulare in omnibus repertum est; in *Omaso* nempé, corpus quoddam durum et compactum, ventriculi parietibus fortiter adhærans, magnae molis, et *intolerandæ graveolentiæ;* in aliis vero partibus repertæ sunt *hydathides, in cerebro, pulmonibus*, sicuti etiam *ingentes vesicæ* solo flatu plenæ, quæ dissectæ *diram Mephitim* exhalarent, *ulcera* in *radice linguæ*, et ad illius latera *vesiculæ sero plenæ*. Illud vero corpus durum, et compactum *ad instar calcis*, quod in Omaso observatur, primum productum esse contagiosi miasmatis, pro certo habeo, dum tacite sævitiem suam exercens, stomachicum fermentum *labefactat* et *corrumpit;* non enim est credibile, post febrem excitatam, conflari hoc corpus intra paucos dies, dum Boves ubi primum febrire cœperint, quodcunque alimentum aversantur, nec quidquam, nisi liquidum per os infundi potest: cætera vero, quæ memoravimus, malignæ febris producta esse, facile crediderim, sed omnium Phœnomenorum exactam rationem adferre velle, non patitur unius horæ ambitus; *ampla* enim *materia* suppeteret, ad *integrum tractatum* conscribendum."

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Symptomata—LANCISI, p. 117.

"Utique vidimus interdum in nonnullis bobus primum indicium contractæ pestis fuisse, fugam arripere, ululare, stertere, ac mille modis quasi subito terrore percitos se se agitare; scilicet quod venenum, cum in iis volatilium salium ubertatem, miramque fibrarum nervearum in spasmos proclivitatem invenisset, diversos statim convulsivos qua externos, qua internos motus induxit. Alios etiam spectavimus, tametsi rarius, *præcoci morte, quasi fulmine tactos* interiisse, eos videlicet, qui natura sua jam *enerves*, spirituque fuerant destituti. Sed in plerisque præcipua exceptæ luis signa extiterunt subito mœrere; caput demittere; e languidulis oculis lachrymas, e naribus, et ore *mucum*, et *salivam* fundere; atque interim febri cum horrore, vel *horripilatione* correptos, nauseantesque humi jacere; semper autem *phlogoses, pustulæ*, ut innuimus, *hydatides*, et *ulcera linguam et fauces* summo cum ardore obsidebant. Principio ut plurimum sitientes multum bibebant; postea vero a potu, ciboque penitus abstinebant; et idcirco cum deglutire, ac ruminare non possent, inedia, sitique celerius etiam, quam natura forte morbi factum esset, ad interitum adigebantur; alvo sæpe sæpius lubrica, dejectisque fœtidis, variegatis, et interdum cruentis humoribus. Plerique tandem omnes *putidi, gravique cum anhelitu*, non raro etiam cum tussi intra primam hebdomadem occidebant. Qui autem ad alteram pertingerent (erant autem perpauci) evadere consueverant; præsertim si *cadentibus pilis corium* exasperaretur, aut *facto ad nates*, et ad *crura decubitu*, ne libere possènt incedere, prohibiti fuissent.

"*Vermes* interim in *naribus*, ad *cornuum radices*, in *labiis atque ore* comperiebantur, quibus scilicet locis muscarum *agmina poterant confluxisse*."

QUID OBSERVATUM FUERIT IN DISSECTIS CADAVERIBUS.

"Quad vero spectat ad ea, quæ in boum cadaveribus detecta fuerunt; illud prænosse convenit, *raro* in peste denatis *certas*, et perpetuas apud illorum viscera affectiones deprehendi; etenim lues a liquidis primo excipitur, et ab iisdem postea aut hæc, aut illa membra pro varia eorundem conditione corripiuntur. Id sane evidentissimum apparuit in *tribus extispiciis*, quæ nos fieri curavimus; nam *præter oris, fauciumque ulcuscula, atque æsophagi, omasi, pulmonumque a rubore subnatum livorem, seu gangraenam;* quas quidem res in unoquoque pene similes comperimus, *diversæ* in singulis occurrerunt viscerum *læsiones*. Etenim in primo, qui tertia morbi die perierat, animadvertimus in omaso tum fœni duriusculam massam, tum *pilam illam*, quam Plinius *Invencarum tophum* apellat, ortam scilicet ex abrasis lingua pilis, et mox deglutitis, subinde vero peristaltici motus ope in modum filtri accedente saliva coactis; *cætera viscera parum a statu sanitatis* abfuerunt. In altero deinde, quoniam interierat 6 die, cum *hepar et intestina tum pulmones sphacelo tentata* erant. In tertio *cor* etiam, et *cerebrum corruptum pene diffluebant* Neque quidquam in ipsorum liquidis constans, et memorandum observare licuit; ob peculiares enim *fluidorum crases* variam quoque illorum fluiditatem, et colores offendimus."

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DESCRIPTION OF PLATES.

PLATE I.

Fig. 1. Lower jaw of a Rinderpest cow. Under lip everted. Showing characteristic congestion of the superficial membrane. Also, its peeling off at a more advanced stage of the disease, from the gum, exposing the raw surface of the mucous coat..... See p. 280.

Fig. 2. Microscopic view of the epithelium from same membrane, partly rolled up into scrolls and cylindrical forms, partly presenting its proper flattened and nucleated appearance; also showing mucous corpuscles, starch cells, &c. The epithelial scales are very granular, and evidently undergoing retrograde degeneration..... See p. 281.

PLATE II.

Fig. 1. Giving the equally characteristic capillary congestion of the mucous membrane of the swollen vulva, the aphthous eruption on the upper part of the left labia near the integuments, the inflamed clitoris and and ropy discharge from the orifice..... See p. 285.

Fig. 2. Section of the 4th stomach of steppe calf No. 14 near the pylorus, showing the ulcer-like depression *beginning to heal*..... See p. 278.

PLATE III.

Fig. 1. Section of the 3d stomach, exhibiting the scarlet rings frequently found in its gastric folds with their denuded and dusky centres.. See p. 282

Fig. 2. (a.) A single papilla attacked, and the capillary congestion commenced and beginning to spread.

(b.) The same seen under the microscope, and the minutest capillary vessels engorged and branching off towards the adjoining papillæ..... See p. 282.

PLATE IV.

Fig. 1. Mucous coat of the 4th stomach, contrasting its earlier and more advanced stages of degeneration..... See pp. 283, 284.

Fig. 2. Same from 4th stomach of inoculated cow, No. 6, showing ecchymoses shining through the violet colored membrane..... See p. 278.

PLATE V.

Fig. 1. Showing complete injection and arborescent forms of the capillary vessels when fully congested in the small bowels.

Fig. 2. Characteristic mahogany appearance of the same after such extreme congestion..... See p. 285.

PLATE VI.

Figs. 1 and 2. Sections of the duodenum in steppe cow No. 8, showing yellow fibrinous masses from Peyer's glands (fig. 2, showing one Peyer's gland and two Solitary Follicles, the exudation being removed from the former at both ends)..... See p. 279.

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PLATE VII.

FIG. 1. Section of jejunum m steppe cow, No. 6, mucous membrane colored blackish by pigment. Peyerian glands strongly injected..See p. 277.

FIG. 2. Section of jejunum in steppe calf No. 32, with one Peyer's gland, the exudation being separated from it. The solitary follicle, hyperæmical and reddened..... ..... See p. 280.

FIG. 3. Section of the large intestines, showing the "zebra appearance" of Boulay as the result of the extreme congestion of the larger vessels of its mucous folds (rugæ) ..... See p. 284.

PLATE VIII.

FIG. 1. Section of the mucous membrane of the cæcum of the vaccinated cow No. 6..... See p. 277.

FIG. 2. Free exudations (like polypus, with depressions, &c.), poured out in great multitude, in the concavity of the small bowels of the steppe calf No. 6..... ..... See p. 280.

PLATE IX.

FIG. 1. Appearance of the hæmorrhoidal congestion of the rectum... See p. 285.

FIG. 2. Highly vascular engorgement of the capillary vessels of the mucous membrane of the wind-pipe..... See p. 286.

FIG. 3. Section of 4th stomach in eczema epizöotica, showing in the dark irregular patches of the hæmorrhagic or sub-mucous effusions in that disease; (observe contrast with appearance of same stomach in the Pest in Plate IV)..... See p. 290

PLATE X.

FIGS. 1 and 2. Colors of newly drawn blood from (1) healthy ox, and (2), from Rinderpest cow ..... See p. 288.

FIGS. 3 and 4. Microscopic field (3) of (1)–(4) of (2), showing in (3) a *few* red corpuscles corrugated from sudden transference of blood when warm to the unheated slide of the instrument; the proportion of white to red cells; the absence of granular matter, and the free almost isolated position of each cell; in (4) the smaller size of the red, and greater abundance of the white corpuscles, their distention, rupture and shedding of contents; their stellar form; the number of granules from broken cells, and the cohesion of the corpuscles in irregular masses..... ..... See p. 288.

FIGS. 5 and 6. Crystals (with white corpuscles), as seen by GAMGEE.See p. 311.

PLATE XI.

FIG. 1. Rinderpest milk, in most advanced stage of the disease, under the microscope, the fatty cells elongated and crowded.

FIG. 2. Healthy milk, the butyric elements floating freely, &c. .... See p. 288.

PLATE XII.

FIG. 1. Flesh of Rinderpest cow, freshly slaughtered with fat, &c.

FIG. 2. " after exposure to light and air for 24 hours, showing change of color and shrinking mostly in the fat.

FIG. 3. Flesh of healthy ox, after like exposure.....See pp. 288, 289.

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PL. I.

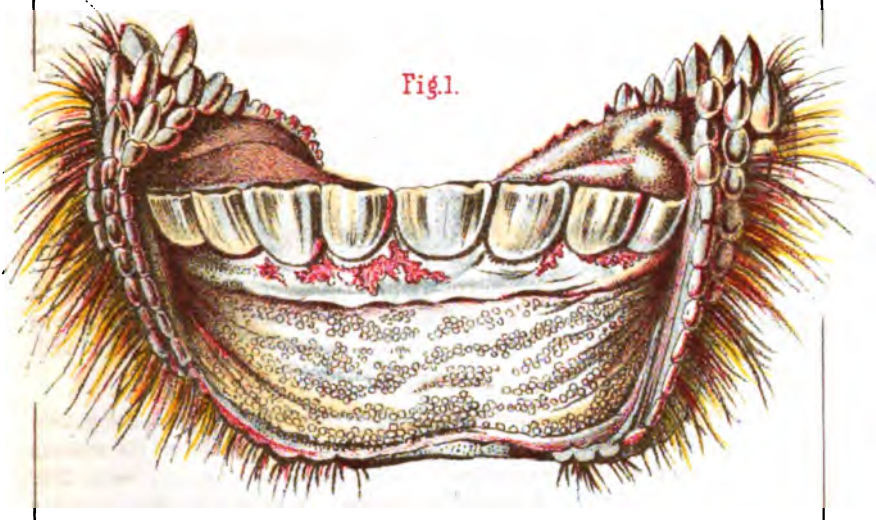

Fig. 2.

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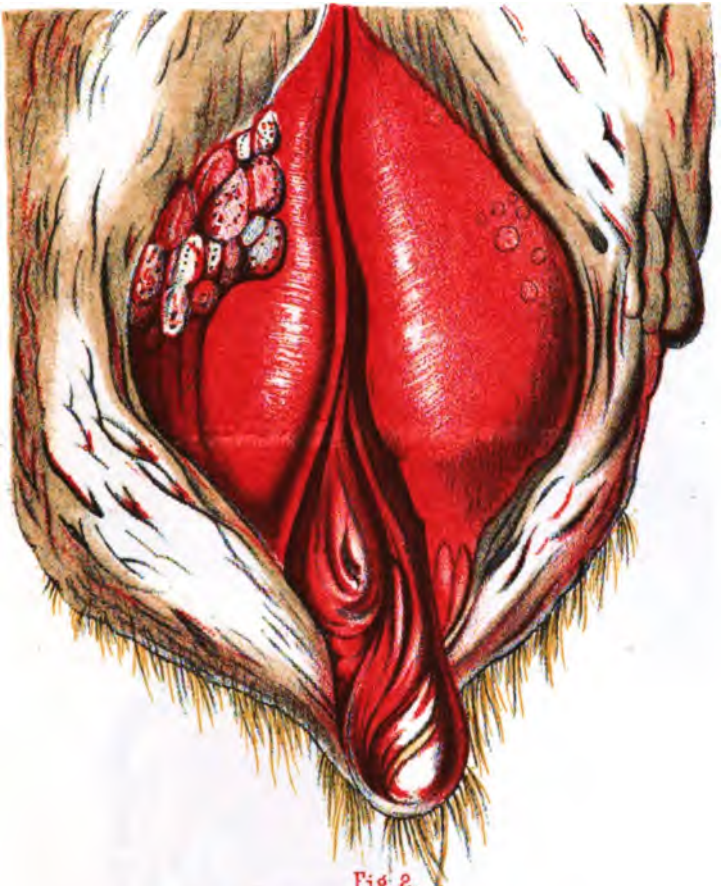
Fig. 1. PL. II.



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PL. III.

Fig. 1.

Fig. 2. b.

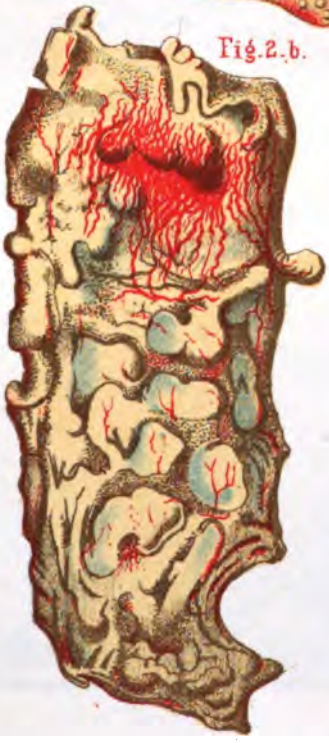

Fig. 2. a.

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PL. III.

Fig. 1.

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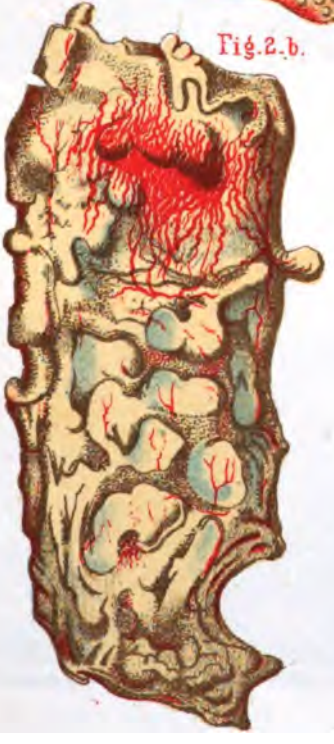

Fig. 2. a.

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PL. IV.

Fig. 1.

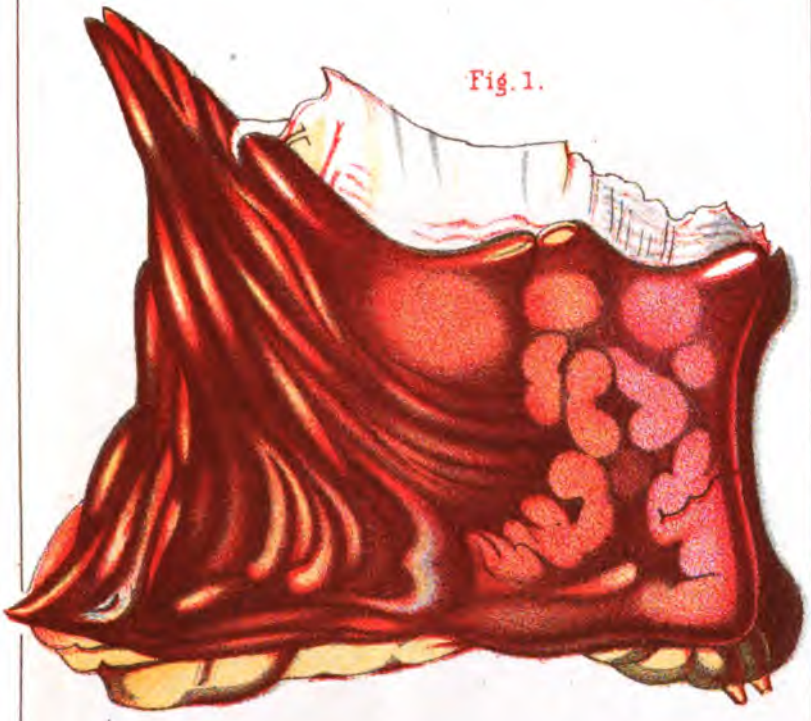

Fig. 2.

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PL. V.

Fig. 2.

Fig. 1.

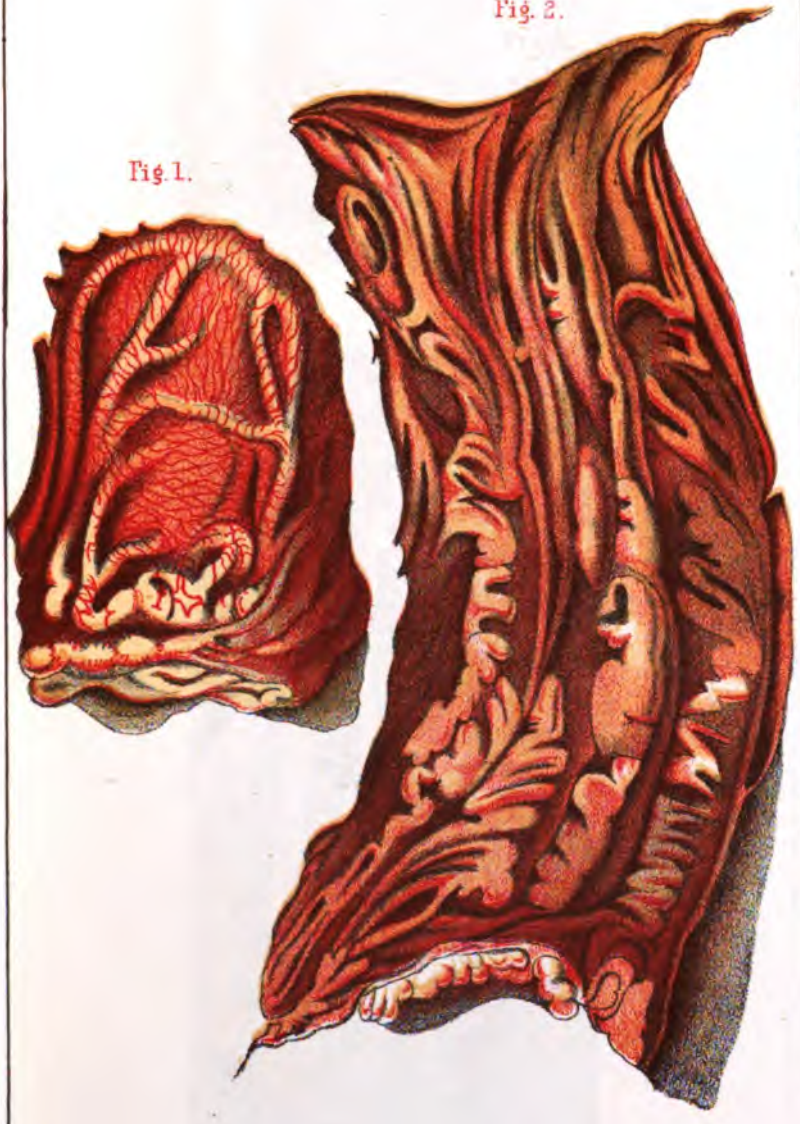

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Fig. 1.

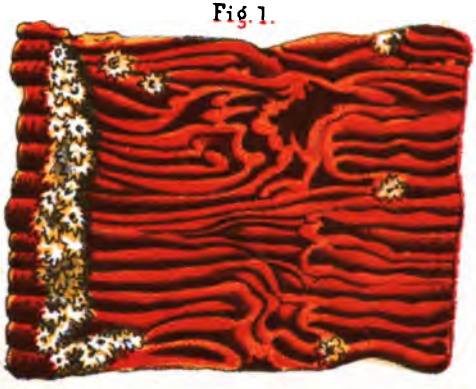

Fig. 2.

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PL.VII.

Fig.1.

Fig. 2.

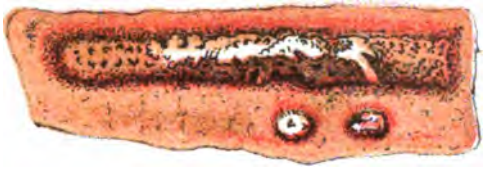

Fig.3.

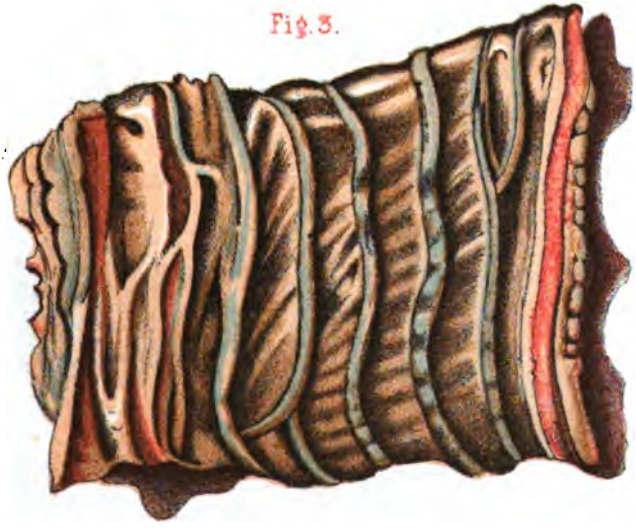

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Fig. 1.

Fig. 2.

Fig. 3.

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PL. IX

Fig 1.

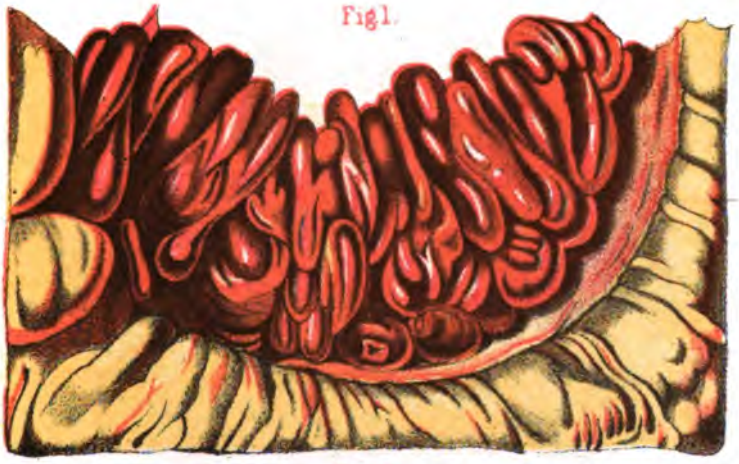


Fig. 2.

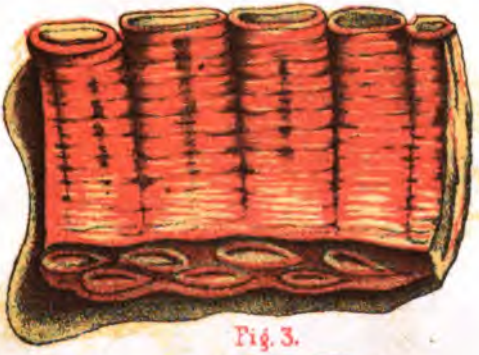
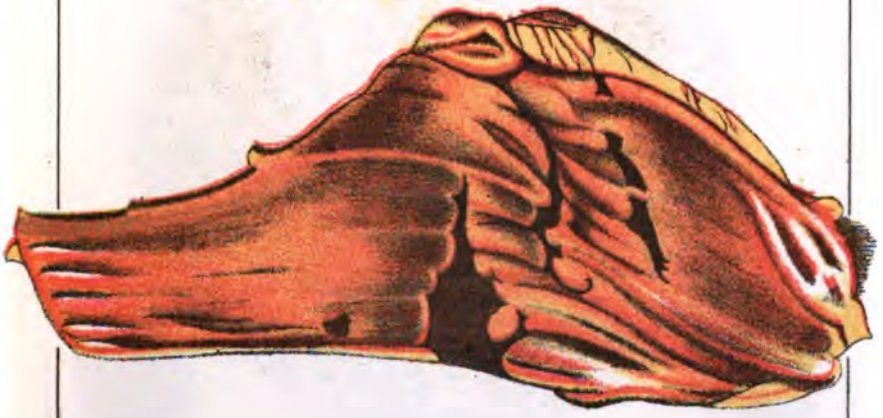


Fig. 3.



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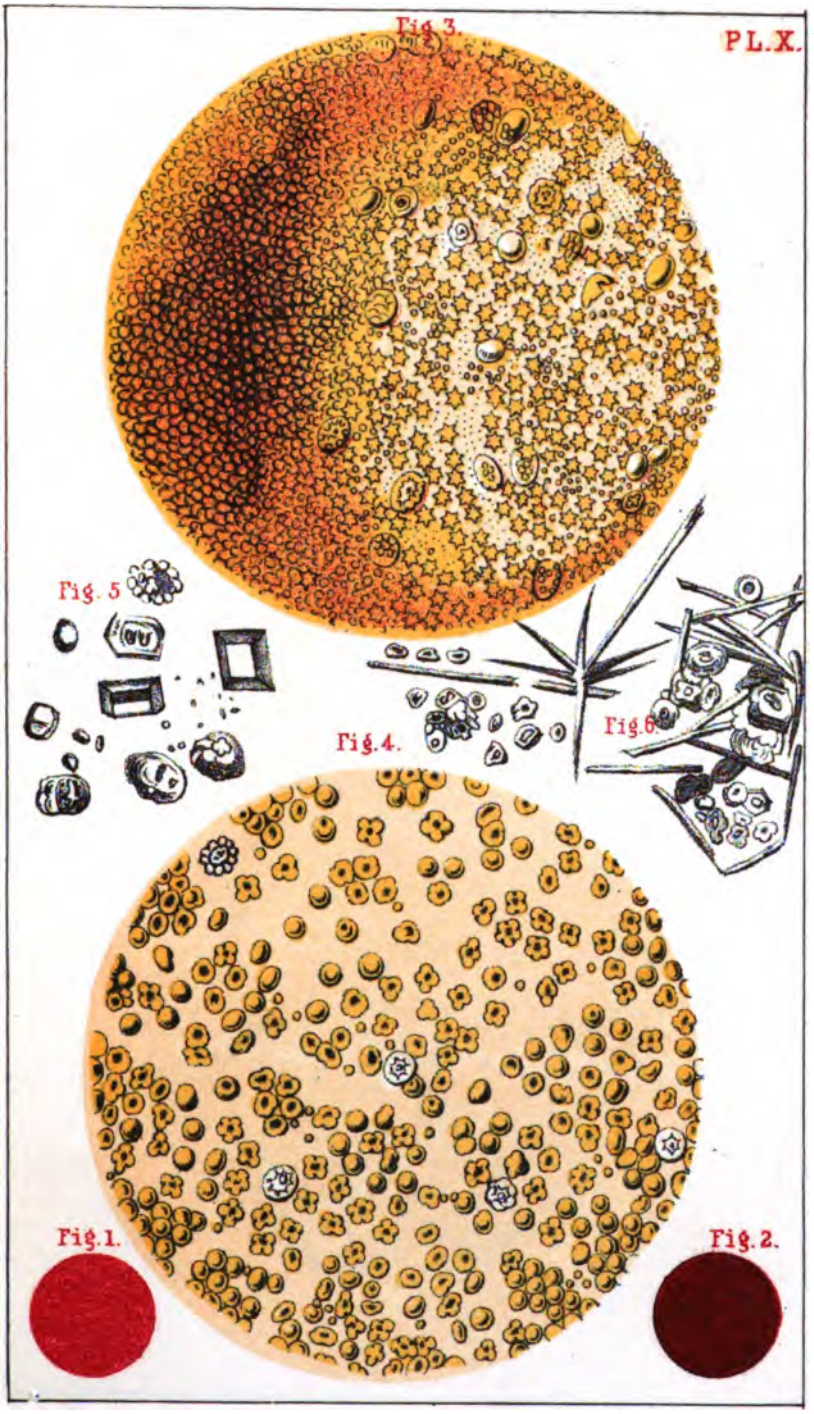

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Fig. 1

Fig. 2.

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PL. XII.

Fig. 1.

Fig 2

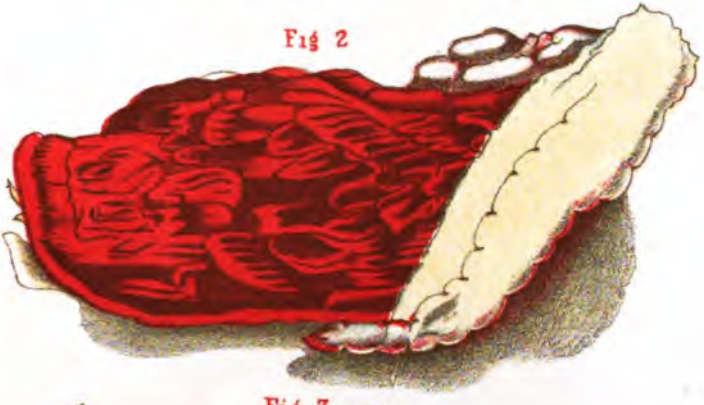
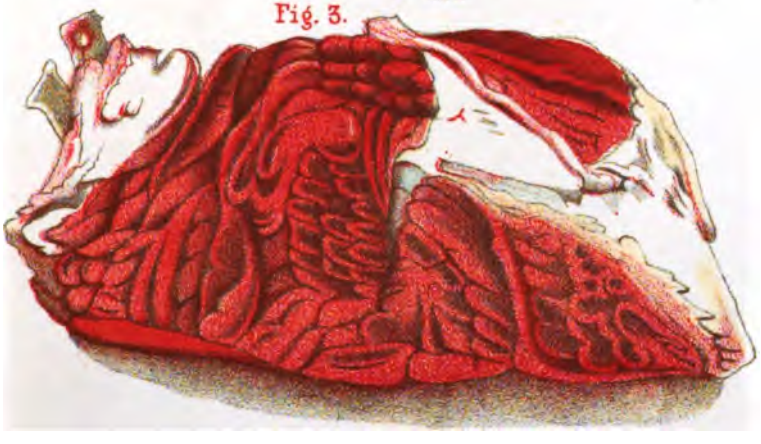


Fig. 3.



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REPORT ON TRIALS OF PLOWS.

INTRODUCTORY CHAPTER.

In presenting their Report on the Trials of Plows, held at Utica, under the auspices of the New York State Agricultural Society, the Board of Judges will not be required to spend much time in insisting on the value of that implement, or in proving its influence upon the welfare of society at large.

It is so generally acknowledged, that it has passed into a maxim, if not into an axiom, that the plow lies at the foundation of all wealth, and is the basis of all civilization. Like other truths of a similar character, which are received without hesitation and without inquiry, it is believed that the real value of the implement is obscured by haze and mist in most minds, and that a few remarks upon this subject will not be wasted if they serve to give greater sharpness of delineation to this idea of its primacy among agricultural implements.

Its use dates back to a very remote antiquity. It is now generally admitted by Biblical critics that the Book of Job is the most ancient writing contained within the canon of the Old Testament. Yet this ancient work begins with an allusion to it: "And there came a messenger unto Job, and said, The oxen were *ploughing* and the asses feeding beside them; and the Sabeans fell upon them, and took them away; yea, they have slain the servants with the edge of the sword, and I only am escaped alone to tell thee."—Job i, 14, 15. In our History of the Plow we have given copies of sculptures on ancient monuments which date back four thousand years.

It is certainly strange, in view of the importance and the antiquity of the plow, that its construction should have received so little attention from scientific men, and the principles upon which it acts should have been so little observed by those who habitu-

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ally use it. The only special treatise upon it, known to us, is the work of Small, which was published late in the last century, and even that tells us very little of its history, or its theory, being mainly devoted to practical details.

The census of the United States for the year 1860 gives the number of acres of improved land in the United States, but unfortunately we are not told how many acres are in grass, or how many under tillage.

We know, however, that in New York about two-thirds of the improved lands of the State is in grass, and that in the State of Ohio about one-third of the improved lands is in grass. The average ratio of the grass to the tillage land in these States is, therefore, as 1:1; or half of the whole of the improved lands are under tillage in these two States. If we may assume that this is the proportion throughout the Union, then, since there are 163,-110,720 acres of improved lands, one-half of the amount, namely, 81,555,360 acres are under tillage, or say, in round numbers, 80,000,000 acres. As Ohio and New York are the chief grass-raising states, it is probable that the average tillage in the other states is still greater than it is in them; but at all events, our estimate would not seem to be an exaggerated one. If now we assume that every plow turns over fifty acres annually, it will require one million five hundred thousand plows to accomplish the work; and if a plow lasts on an average eight years, it will take one hundred and eighty-seven thousand five hundred new plows every year to supply the demands of our country, without referring to the large number exported to foreign countries.

There are 833,412 farmers in the United States who own from three to fifty acres, and 1,121,602 who cultivate farms between fifty and one thousand acres each. Or, there are 1,955,012 independent cultivators of the soil. The above calculation would agree with a purchase of one new plow by each cultivator every tenth year.

The number of establishments in the United States for the manufacture of plows, harrows and cultivators, is four hundred and twenty-three, and the total value of these products is $2,855,-248. If we suppose that one-third of this value is to be deducted for harrows and cultivators, it will leave $1,903,499 as the value of the plows manufactured annually; and if we assume that the average value of each plow is ten dollars, we shall have a result which varies very slightly from the estimate we have given.

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Having, therefore, obtained a similar result by three different and independent processes, we may with some confidence assume, as the annual production, 187,500 plows for domestic use.

We have endeavored to ascertain the annual value of the plows made in this country and exported to foreign countries, but, from the fact that all the agricultural implements exported are given in the official tables under one head, without any attempt to specify the number and value of each machine, it is impossible to ascertain the number or value of the plows exported. The Ames Plow Company have for several years exported about one hundred thousand dollars worth annually, and other makers, in the opinion of the revenue officers, export two hundred thousand dollars worth more, which makes the whole value of the plows exported, three hundred thousand dollars. It is believed that the value of this export might easily be increased ten-fold.

The plowing of the land under cultivation in the United States requires, according to our estimate, the labor of one million teams of either oxen, mules or horses for eighty days in the year; and we do not think the average value of the men and teams required for this purpose can be reckoned at less than two and an half dollars a day for each plow. This would make the aggregate cost of the plowing in each year to be $20,000,000.

We have shown in a subsequent chapter, that there is a difference of power required to perform the same amount of work by different plows, amounting to forty-six per cent, as shown by careful trials in England, and to forty-two per cent, according to the trials instituted by this Society in 1850.

It follows from this, that if the plow having the least draught was brought into universal use, to the exclusion of those which require a greater power, it would reduce the cost of plowing in the United States forty-two per cent, or it would reduce it from $20,000,000 to $11,600,000, leaving $8,400,000 in the pockets of the farmers, as a fund to be applied to the payment of taxes or the improvement of their farms.

If we suppose that the same number of men and teams were employed as heretofore, then they would be enabled to cultivate an area forty-two per cent greater with the same expenditure of power that they now employ; that is, they would cultivate an area of (113,600,000) one hundred and thirteen millions of acres, without any more expenditure of power than they now do (80,000,000) eighty millions of acres.

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The annual value of the crops produced on the present area of plowed land in the United States, may be roughly estimated at ($900,000,000) nine hundred millions of dollars, or eleven and a quarter dollars per acre.

If, by the use of better plows, we can increase this amount forty-two per cent, the aggregate increase would he ($378,000,000) three hundred and seventy-eight millions of dollars.

We do not mean to assert that this sum would represent the actual increase of the annual value of the products of agriculture, but allowing each reader to make the deductions which he may think necessary for the increased cost of cultivating this increased area, such as seed, planting, after-culture and gathering, it will be seen that the use of the best form of the plow will increase the aggregate profits of agriculture to an extent equal to the annual national internal taxation of the United States.

In view of the benefits which we have shown will result from the adoption of the best form of the plow, it is obvious that no amount of labor or expense which our agricultural societies can bestow upon it with a view to its improvement, will be misapplied or wasted.

We are not without hopes that our labors to this end at Utica will be thought by our agricultural brethren to have yielded some good fruits, and that this success will prove a sufficient stimulus not only to our own Society, but to other State Societies in the United States, to continue this rigid system of observation until all the laws of the plow shall have been discovered and accurately stated for the benefit of the farmers of our country.

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CHAPTER II.

THE HISTORY OF THE PLOW IN EUROPE.

It is impossible to say who was the first inventor of the plow. The earliest records speak of it as a well-known instrument of husbandry, and we are therefore left to conjecture respecting the origin of the mellowing of land to fit it for the reception of seeds and the growth of grain.

The inhabitants of the earth must have observed, at a very early period of its history, that ground which had been accidentally loosened bore a more abundant harvest; the rooting of hogs must have given them sufficient examples of this, if nothing else had suggested it to them.

The next step, after they had become fairly conscious of this fact, would be to imitate it at such places and at such times as experience had shown them was most desirable. Probably a sharpened stick would be the most likely instrument to suggest itself to their minds; then they would widen the end of it, sharpening it to a chisel edge with a view of making more rapid work.

Man in the hunter, and even in the pastoral state, is very averse to bodily labor. The little inventive power that he possesses will surely be directed to the making of contrivances which will release him from bodily toil. While working the land with his sharpened stick, with his mind intent upon some mode of ameliorating his condition, he sees the bulls and cows grazing on the hillsides around him; they are stronger than he, and he desires to subjugate their strength to his service. Seeing a forked stick in his path, a bright thought dawns upon his mind; he will tie the long end of a stick to the horns of a bull, while the short end will run into the ground and stir it much faster than he could do it with sharpened stick, and with much less labor to himself. He tries his the experiment, and cries, Eureka! or some barbarous equivalent for that Greek word. The germ of the plow is at length invented.

The process by which the first man arrived at this result may be pure conjecture; but that the forked stick was the origin of the plow, we have the most ample evidence.

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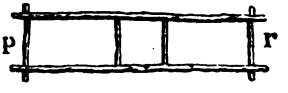
Fig. 1 is copied from an ancient monument in Asia Minor, made wholly of the natural crooks of the branch of a tree, the only artificial contrivances being the brace *e*, which strengthens the share *c b*, and the pins in the fore part of the beam *a b*, and connect it with the central division of the yoke *p r*. It was with a plow like this that the servants of Job were "plowing in the field when the Sabeans came upon them and drove them away." It was with such an one that Ulysses plowed among the sands of the shore at Ithaca, when he feigned madness before the messengers of Agamemnon.



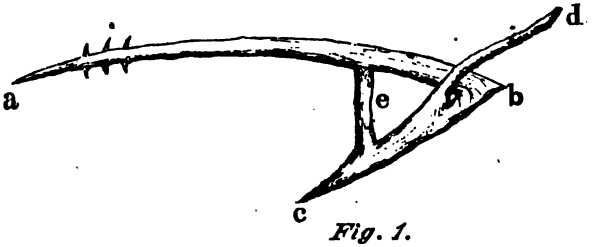


Fig. 1.

The most ancient monuments of Egypt, dating back at least three thousand years before the Christian era, reveal to us a slight modification of this implement, quite as rude in form, yet somewhat more powerful in execution.

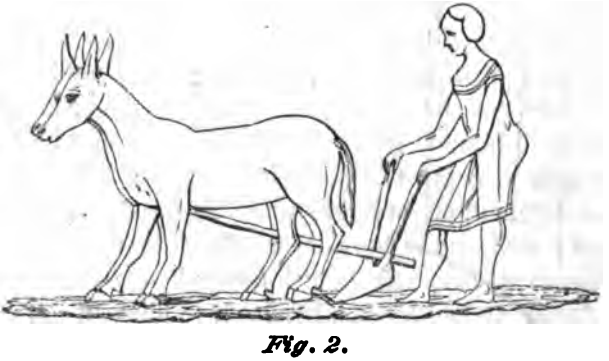


Fig. 2.

Fig. 2 is a copy of these figures. It will be seen that the share being triangular in form, will take a broader furrow, while two handles in the place of one give the plowman a greater command over the instrument.

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The most ancient form of the Roman plow used in the days of the Tarquins, is given in Fig. 3.

A more recent form of the implement, as used by Cincinnatus and Cato, is given in Figs. 4 and 5, which will be found to agree exactly with the description of the implement given by Virgil in the Georgics. The sole of the plow, A B, has two rectangular pieces of wood, G and H, fixed to it on each side, forming an acute angle with it, in which the teeth, E F (*dentalia*), are inserted. This exactly answers the description of Virgil: "Duplici aptantur dentalia dorso;" (the teeth are fitted to the double back.) E and F project obliquely upward, and perform the office of a mould-board. The share, B, was of metal.

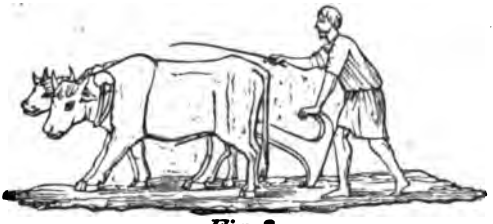

Fig. 3.

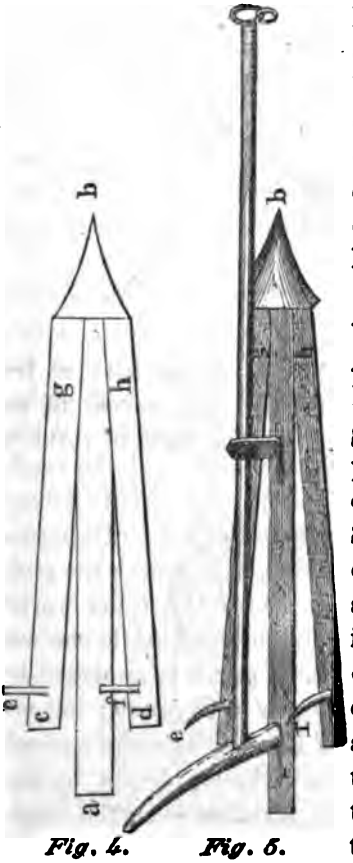

Fig. 4. *Fig. 5.*

The next improvement in the plow was to cover the point with iron. A very ancient implement of British husbandry, called the CASCHROM, is given in Fig. 6, which is used as a plow at this day in some parts of the outer Hebrides and in the Isle of Sky. Like the preceding examples of the implement from Asia Minor and Egypt, the wooden portion of it is in one single piece, and has evidently been selected on account of the natural crook which it had assumed in the tree, that permits the part *a d* to run nearly horizontally, while the upward curve of the handle, *a c*, rises to the shoulder of the plowman, and is allowed to rest upon it. When he desires to make it go deeper into the ground, he raises *c* on his shoulder; when it runs in too deeply, he presses with his foot upon the pin *e*. It is armed with an iron chisel at the point *b*,

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having a socket at the upper end, *d*, into which the fore end of the wooden part is firmly wedged.

Fig. 6.

Fig. 7 is the figure of an East Indian plow now in the Museum of our Society at Albany. Its form has not been altered for centuries, and in some portions of India it is the only plow in use.

The Greeks, who always had a piece of history for every emergency, tell us that Ceres, or Demeter, as she was called by them, who was the daughter of Saturn and Rhea, and the mother of Proserpine by Jupiter, was the inventress and guardian of agriculture. The story goes, that one day as Proserpine was gathering flowers in the fields of Enna in Sicily, Pluto came and carried her away, to be the queen of the lower regions. Ceres was disconsolate for the loss of her daughter, and for a long period devoted herself to searching for her over the whole earth. While she thus devoted herself to this search, she neglected the earth, which thus become barren. Jupiter, and all the gods in succession, besought her to abandon the search and return to Olympus, but she refused, and would not be consoled. At length the gods persuaded Pluto to allow Proserpine to revisit the upper world, remaining with her mother two-thirds of the year, while she was still to return to him for one-third of it. Ceres was appeased by this arrangement, and consented to return to Olympus; but ere she went, she taught to Triptolemus of Eleusis the art of agriculture, giving him at the same time her chariot drawn by two dragons, in which, by her command, he traveled over the whole earth, distributing corn to all the inhabitants. Triptolemus, under her inspiration, was the inventor of the plow.

The Greeks had two festivals in honor of Ceres, which were called *Thesmophoria* and *Eleusinia*. The Romans, who were greatly devoted to agriculture, were ardent worshippers of Ceres,

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Fig. 7.

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having many temples devoted to her service, and one annual festival called the *Ceralia.* This festival was celebrated by matrons holding burning torches in their hands, and whoever ventured to appear without previous *initiation* was punished with death.

This divine origin of agriculture was devoutly believed by the Greeks and Romans, as well as the Egyptians; but like all other false beliefs, it worked great practical injury. It was reckoned impious to change the processes which had been expressly revealed from heaven, lest they should appear to derogate from the wisdom of Ceres, and thus incur her displeasure; which, of course, was an absolute barrier to all improvement. In fact it would seem that the shadow of that delusion has reached down to the present day, since, in no art known to man, is it so difficult to give currency to new processes as it is in agriculture. A very large portion of the farmers still use implements as rude as those we have already figured. In fact the Caschrom is still in use in some parts of the Hebrides.

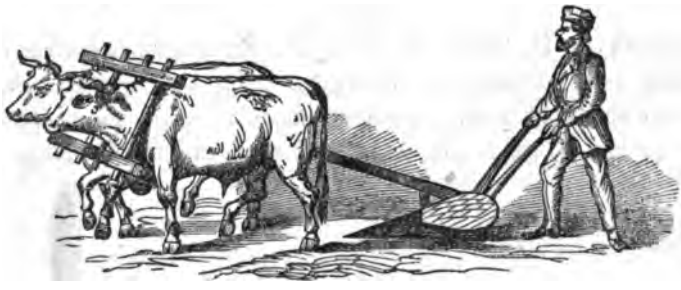

Fig. 8.

In Fig. 8 we give the plow used throughout Egypt at the present day, which is but a very slight improvement on the ancient implement represented in Fig. 2. Fig. 9 is an accurate representation of a plow now in our museum at Albany, such as is almost universally used in Mexico. Even in France, Spain and Italy the plows used are of the most awkward kind, incapable of doing good work, and excessively wasteful of power.

The next step in improvement seems to have been the substitution of a more decided wedge form in the plow for the triangular sticks of an earlier age. In some cases the leading idea of the plowmaker seems to have been to have the wedge act horizontally, lifting up the earth; in others the edge was formed to act laterally, pushing the slice cut off by the point, over to the other side, so as to leave a free space for the next furrow.

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Fig. 10, Chinese plow in the museum of the New York State Agricultural Society.

Fig. 11 represents a plow figured from the Harleian manuscript No. 4,374, such as was used in England in the reign of Edward

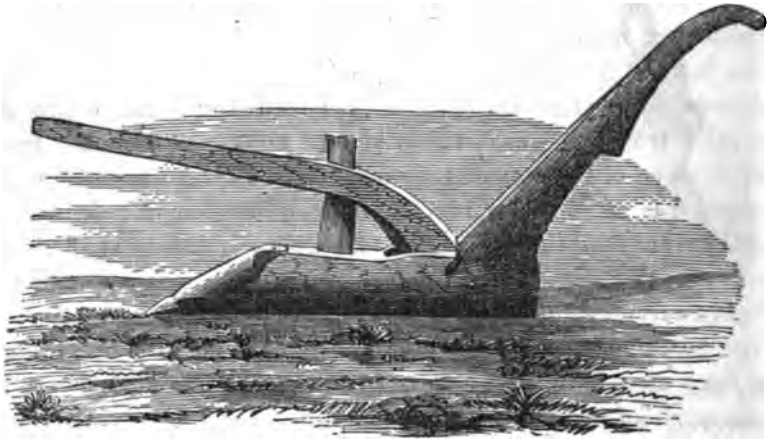

Fig. 9.

the Fourth, A. D. 1470. It is formed from a rhomboidal piece of wood, bent or grooved downward from the middle towards the front and rear, with the edges turned upward, the acute ends being turned towards the front and rear, the front being shod

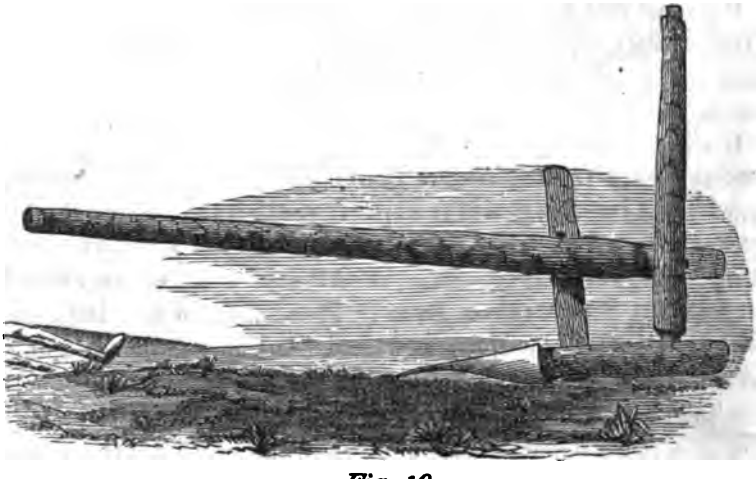

Fig. 10.

with iron. In this way the earth is scooped up from the solid earth, pushed backward and upward to the middle line of the share, when it falls backward in a pulverized state into the furrow from whence it was taken.

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Fig. 12 is taken from an old Saxon calendar, preserved in the Cotton manuscripts of the eleventh century, and used in the time of William the Conqueror. It was drawn by four oxen, and fastened to them by ropes made of twisted willows, and sometimes

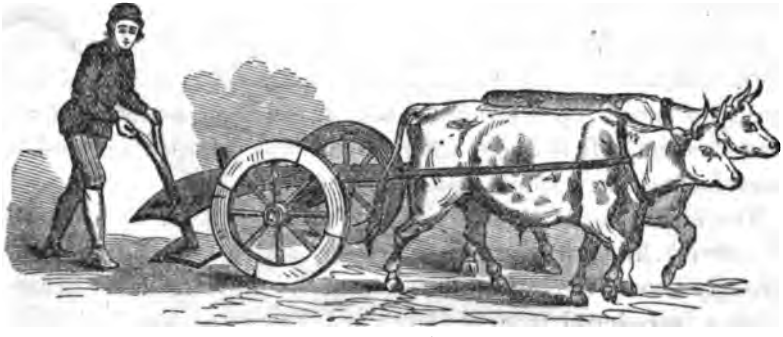

Fig. 11.

by the skins of whales. It consists of a simple wooden wedge covered with straps of iron, one side being placed parallel to the line of the plow's direction, the other sweeping over to the left hand, clearing it from its own path, and leaving an unobstructed furrow for the next slice. A coulter, not unlike those now in use, is inserted in the beam, and a wheel is placed in front to regulate the depth.

We have met with nothing previous to this plate which shows a real coulter, or that which we now call by that name. Virgil's plow had none, nor were any of the Italian plows provided with one in Tull's day.

It will be seen from the two last illustrations that the idea of a wedge form for a plow had begun to dawn upon men's minds; some using the wedge acting vertically, others laterally; but they

Fig. 12.

existed in the minds of plowmakers in too vague and misty a form to be of much practical benefit. No one had as yet grasped the idea of combining the two wedges in the same implement, nor had they any idea of the curves by which this could be effected.

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There is a plow now in the museum of the Society at Albany, from Canada, derived from France, which has been in use there unchanged for centuries, although no one knows how many, which seems to be the first feeble attempt to realize this idea. We give a drawing of it in Fig. 13.

It will be seen that this is the twisted wedge raising up the earth first and then twisting it to the right. It is furnished with two wheels to keep it steady in the furrow, and a coulter of the modern form. It is a rude affair when compared with our modern implements, but it shows real genius in its author.

The beginning of the last century was signalized by a revival of interest in agriculture in England, and attention was more strongly turned to the improvement of the plow than ever before. A plow introduced from Holland, and known as the Rotherham plow (many persons suppose this name to be a corruption of Rotterdam), was first constructed by Joseph Foljambe of Yorkshire, which he soon after sold to Mr. Staniforth, who did not manufacture them himself, but charged a royalty of two shillings and sixpence on the manufacture by others; but when he attempted to raise the price to seven shillings and sixpence, the validity of his patent was contested and set aside by the courts on the ground that it was not a new invention.

This plow became very popular among the more enterprising farmers; but notwithstanding its work was much better, and its draft was much lighter, it came very slowly into use among the masses.

Fig. 14, land side of Rotherham plow. Fig. 15, furrow side of Rotherham plow.

DIMENSIONS OF THE ROTHERHAM PLOW—FIG. 15.

	Feet.	In.
From the end of stilt, E, to the point of the share, I	7	4*
From the end of beam, A, to point of share, I	3	0*
Length of the beam, A, B	6	0
Width of the head in the widest part, T	1	4
Width of the head at J	0	9
Width of share at D	0	3½
Length of surface on which the plow touches the ground, J, I	2	10½
Height from ground where the coulter goes through	1	8
Width between stilts at extreme end	2	6
Height of stilts from ground	2	10
Weight of wood and iron work	1¼ cwt.	

* These measures are taken by dropping a perpendicular to the plane of the sole, and then measuring horizontally.

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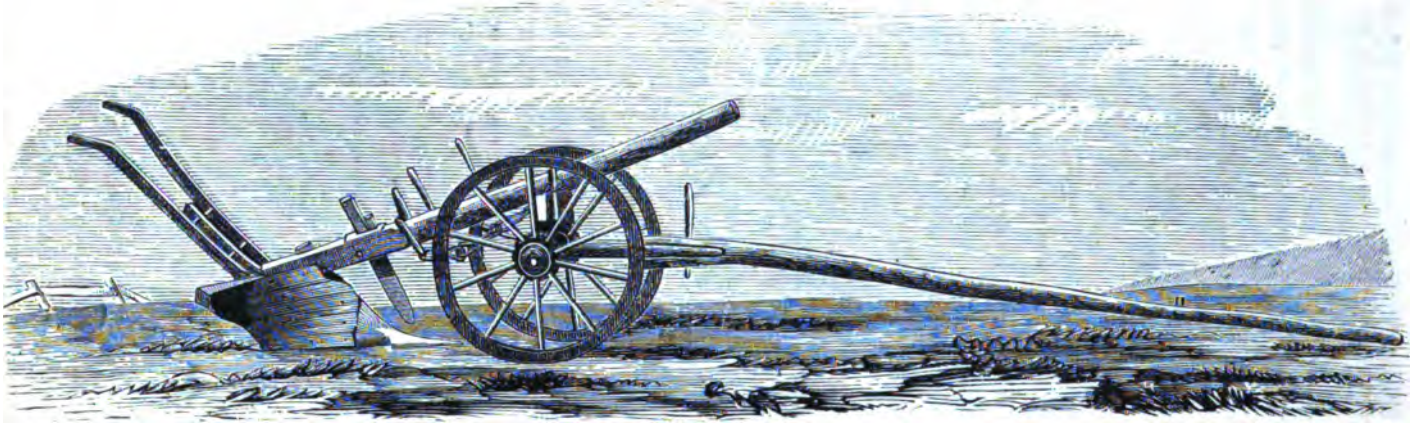

Fig. 13.

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This plow was made of wood, covered in the working parts with sheet iron, which needed frequent renewal. It is the first, so far as we know, which provided a bridle, *e*, Fig. 16, by which the plow could be turned to or from land. The point is conical,

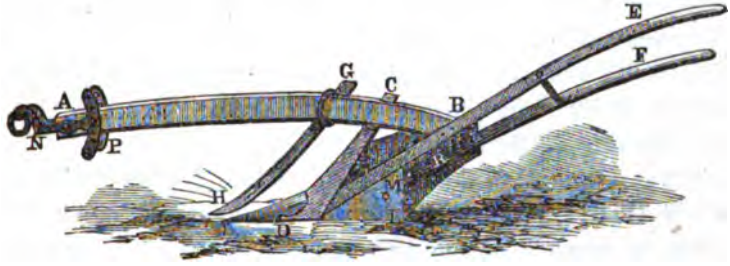

Fig. 14.

which enters the land on the principle of burrowing or mining, rather than by the clean chisel cut now adopted, which must have considerably increased the power required to operate it; still, a comparison of it with its predecessors shows that it must have

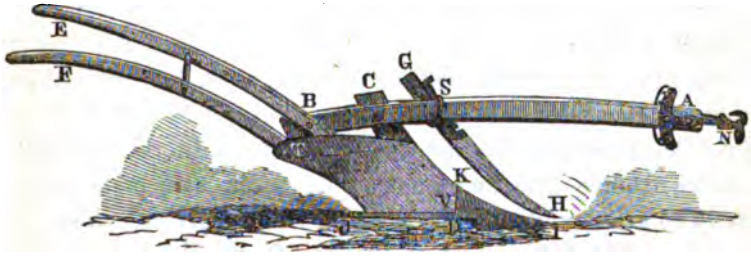

Fig. 15.

done much better work, and with less expenditure of power. It will also be seen, on examination of the mould board, that the maker had empirically approximated to the true theory, as the two wedges, lateral and vertical, are connected by a curve line, so that the furrow slice is first raised a little and is then gradually turned over to one side.

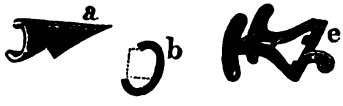

Fig. 16.

Ten years after the letters patent were granted to Foljambe for the Rotherham plow, Jethro Tull published a work on "Horse-hoeing Husbandry," the first edition of which was published in 1730. In this work, although Tull was a thorough radical in the cause of agricultural improvement, he gives the preference to the old Berkshire plow, which will be seen, on comparison with the Rotherham plow, to be far inferior

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to it in ease of management, in ability to do good work, and in lightness of draft.

We give this plow and its subordinate parts on Plate I, as illustrating the history of plows, and as a curious example of the slowness with which real improvements were adopted in agricultural communities. We may add, that Tull published another edition of his work in 1762, thirty-two years after the introduction of the Rotherham plow, in which he still adheres to his preference for the old Berkshire.

Tull was strongly in favor of four coultered plows, such as is shown in Plate I, fig. 2. His eighteenth chapter is devoted to a dialogue between a farmer and himself, in which he gives his reasons for his preference of that form of plow. His chief reasons are briefly these: It divides the land more completely, affording greater access to air and moisture. The furrow being cut into four parts, it will have four times the superfices that it would have without the coulter cuts; but this is not all. "It is more divided crossways, viz: The ground wrest presses and breaks the lower (or right hand) quarter; the other three quarters, in rising and coming over the earth board, must make a crooked line about a fourth longer than the straight one they made before moved; therefore, their thinness not being able to hold them together, they are broken into many more pieces for want of tenacity to extend to a longer line, contrary to a whole furrow, whose great breadth enables it to stretch and extend from a shorter to a longer line without breaking; and, as it is turned off, the parts are drawn together again by the spring of the turf, and so remain whole after plowing."

The objects which Mr. Tull sought to accomplish were very desirable, but the four coultered plow was never very generally adopted; and as the same objects have been since accomplished in a far more simple and philosophical manner, it has fallen into utter oblivion.

Fig. 1 represents the old Berkshire plow, pure and simple. The plow head consists of a pair of wheels, A B, and their axis. Two crow staves, D D, through which two rows of holes are perforated, by means of which the pillow, E, upon which the beam rests, is elevated or depressed. H, the tow chain which fastens the plow to the head. L, the bridle chain, one end whereof is fastened to the beam by a pin, and the other end to the top of the stake, which is held up to the left crow staff by the ring M.

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Plate I.

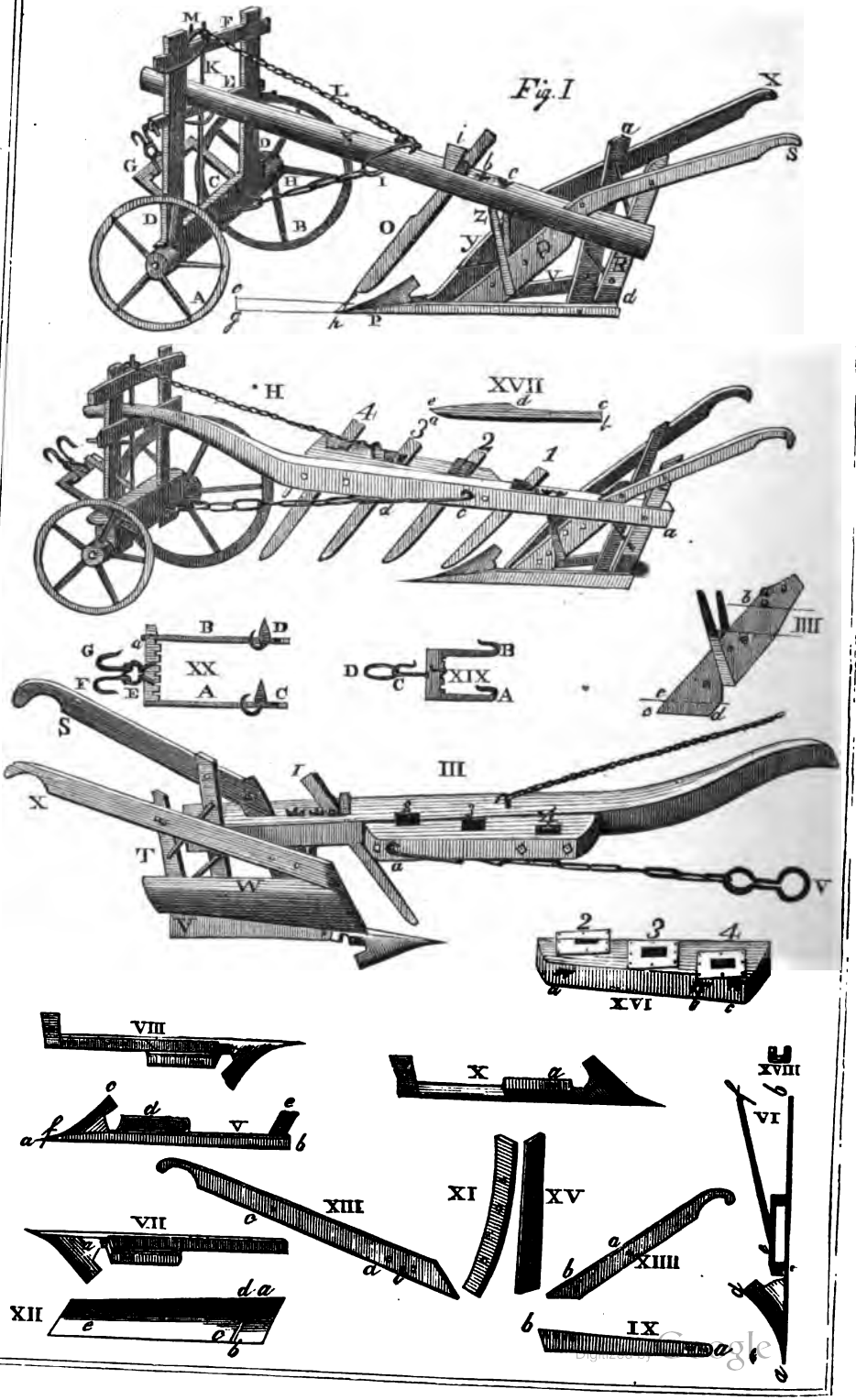

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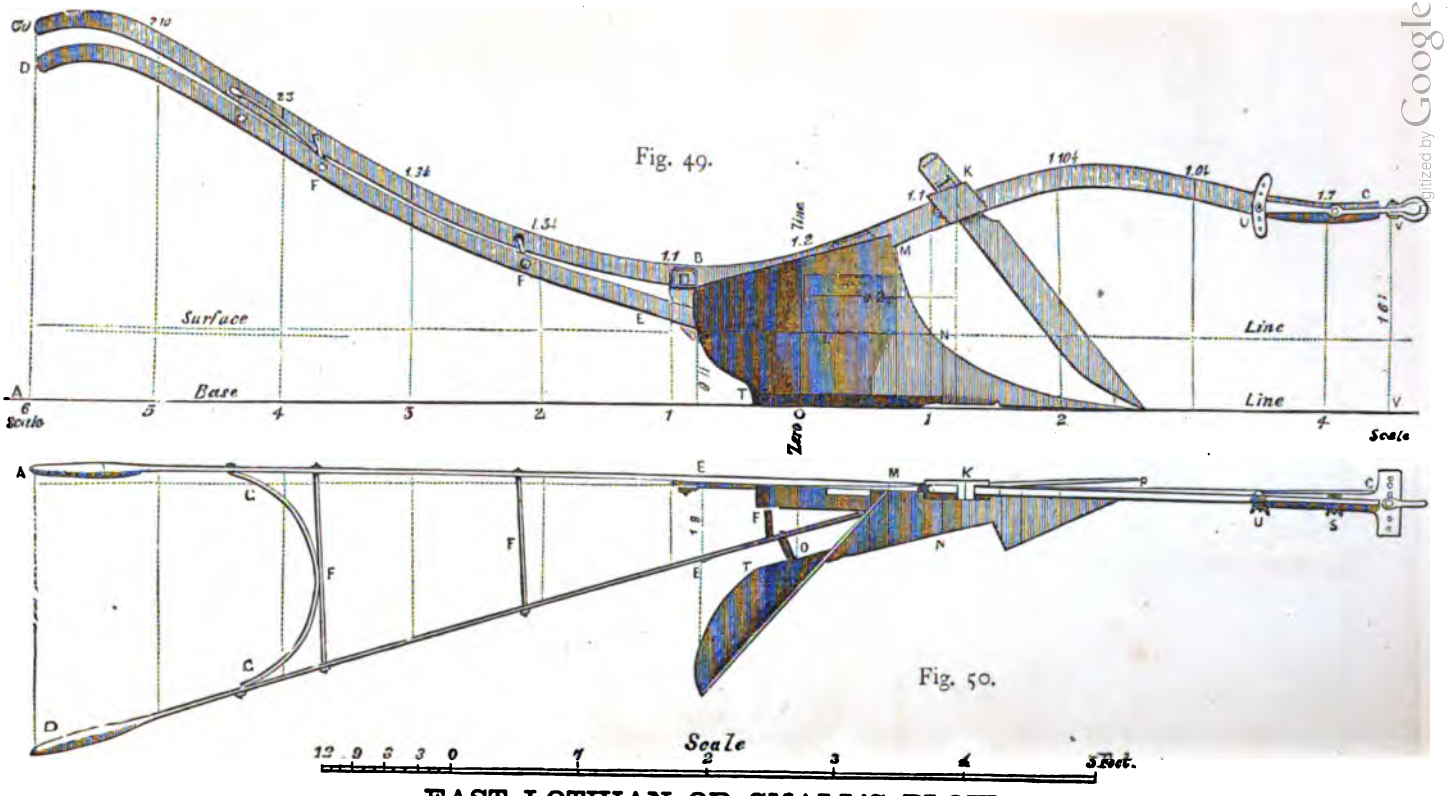
Plate II.



EAST LOTHIAN OR SMALL'S PLOW.

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The plow tail consists of the beam, N, the coulter, O, the share, P, and the sheat, Q; the hinder sheat, R, passing through the beam near its end. T, the drock which belongs to the right side of the plow tail, and whereto the ground wrest, V, is fastened, as is the earth board, whose fore part, W, is seen before the sheat. Z is the double retch which holds up the sheat.

We have retained the antiquated nomenclature of Tull in this description, as these words are still retained in some English works, and would not be understood by American readers without a plate with references were before them.

Fig. 2 represents the four coultered plow recommended by Tull. The beam differs in length from the former one, being ten feet four inches long, or two feet four inches longer than the other. It differs also in shape, being only straight from *a* to *b*, from thence curving suddenly upward, as shown in the figure. The perpendicular height at *a* is eleven inches, at *b* one foot eight inches, while the height of the beam where it rests upon the pillow is two feet ten inches above the plane of the sole.

From the end *a* to the back part of the first coulter is three feet two inches; from thence to the back of the next coulter is thirteen inches; from thence to the fourth is the same. From *a* to *b* is seven feet.

The beam is made of ash or oak, and is five inches deep and four inches broad at the first coulter.

Fig. 4 is the *sheat*, seven inches broad, with the iron *retch* upon it, the left leg of which must stand foremost. The ends pass through the beam, and are secured on the top by nuts; the sheat is also mortised into the beam and secured by a pin passing through the hole *a*. The angle *b c d* must always be less than 45 deg.; from 42 deg. to 43 deg. works best in practice.

Fig. 5 is the *share*, *a*, the end of the point; *b* is the tail of the share; length from *a* to *b* is three feet nine inches; *c* is the *fin;* *d* the socket into which the bottom of the sheat enters; *e* a thin plate of iron to which the hinder sheat is riveted. From *a* to *f* is the *point*, three and a half inches long, flat beneath and round above. From *f* to *c* is the edge of the fin, which should be of steel.

Fig. 6 shows the share with its right side upward as when plowing; the side *a b* should be perfectly straight, but its under side, *c*, should be a little hollow.

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Fig. 7 is the share turned bottom upward, showing concavity *a* of the fin, which must be greatest in a stony, rubbly soil.

Fig. 8 shows the share right side upward, but leaning towards the left.

Fig. 3 shows the upper and right side of a four coultered plow, of which V, the iron ground wrest, is shown in Fig. 9; it is two feet five inches long, four inches deep at the end *b*, and three-eighths inch thick, except at the end *a*, where it is thin enough to bend so as to set close to the share, as at *e*, fig. 6. The ground wrest has four small holes near its end, *a*, into one of which a nail is inserted, which fastens it to the sheat through the long hole in the side of the socket of the share, as at *a*, fig. 10, when it will stand in the position *e f* in fig. 6. From the outside of the ground wrest at *f*, to the outside of the share at *b*, is eleven and a half inches. The ground wrest has several holes at the upper side of its broadest end, as at *b*, in fig. 9, by which it is nailed to the lower part of the drock T, as in fig. 3, which drock, with its perforations, is shown in fig. 11

Fig. 12 is the earth board (mould board), with its inside upwards; the notch *a b* shows the rising of the wood which takes hold of the sheat, to which it is fastened by the holes *c* and *d*, and at the other end it is fastened to the drock by the hole *e;* all which is seen at W, in fig. 3. The pin with which it is fastened to the drock is larger in the middle than at either end, which prevents the earth board from coming near the drock; by this pin the distance between them is regulated, so that the rear end of the earth board may be thrown inward or outward, according to the requirements of the soil.

Fig. 13 is the long handle, five feet four inches long, and four inches in the widest part; it is pinned to the sheat through the holes *a b*, and to the drock through the hole *c*.

The short handle, S, is fig. 14; is three feet nine inches long, and is pinned to the hinder sheat, fig. 15, by the hole *a*, and to the top of the fore sheat above the beam by the hole *b*.

Fig. 16 is the piece for the mortises in which the coulters are inserted; the lateral distance between them is two and a half inches. The fore part of every mortise should incline a little to the left, so that the backs of the coulters may not bear against the lett side of the incisions made by their edges. In setting the coulters, each should stand nearer to the perpendicular than the

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one behind; or, in other words, the forward coulter should have the least rake, and the rear coulter the most.

Fig. 17 is a coulter, *a b;* its length is two feet eight inches, *e d;* its edge is sixteen inches long, *d c;* the length of its handle is sixteen inches, one and seven-eighths inches broad, and seven-eighths inch thick.

Fig. 18 is a nut with its two opposite corners turned up so as to be driven by a hammer.

Fig. 19 is an iron collar (bridle) by which the tow chain is fastened to the beam, as seen at *a*, fig. 3. The notches are intended to facilitate the direction of the share to or from land. The length of each side of this collar is one foot.

The tow chain is shown in fig. 3, where the link Y is secured by the stake, as shown in fig. 1.

Fig. 20 is the iron wilds. The distance between the two legs is eight and a half inches; their length is nineteen inches. Its position is seen in figs. 1 and 2; the notches are intended to give a broader or narrower furrow. E is the ring by which the two links and the two crooks, F and G, are held together, and on which they all move.

The diameter of the left wheel in fig. 2 is twenty inches; of the right, two feet three inches; their distance asunder is two feet five and a half inches.

The crow staves are one foot eleven inches high from the box to the gallows, and their distance apart is ten inches. The height from the plane of the sole to the hole in the box where the tow chain passes through it, is thirteen inches, which is two inches below the holes of the wilds on the rear face of the box. The height at the other end, where the crook of the collar takes hold of the pin of the beam at *c*, fig. 2, is twenty inches high.

No other noticeable changes were made in the plow until near the beginning of the present century, when the conviction that there was a real law of nature which ought to regulate the shape of the plow, began in a vague and misty way to take possession of men's minds. They felt instinctively that the implement was too complicated and cumbrous, and that it was quite possible to simplify it and to diminish its draft.

One of the earliest laborers in this field was Thomas Jefferson, late President of the United States, who, in a communication to the French Institute, attempted to solve the mathematical problem

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of the true surface of the mould-board, and to lay down intelligible and practical rules for its formation, for the first time.

He saw very clearly, and we believe he was the first to discern it with distinctness, that the plow should consist of two wedges, one acting vertically and the other laterally, which should be so blended in a curve surface that the furrow should rise and turn over smoothly and continuously.

It is impossible to over-estimate the value of this contribution to agricultural science. All the old writers complain that when the makers of good plows died, their art died with them. Their plans being purely empirical, they could not communicate the true mode of making them to others, and hence the art was lost as fast as it was found. Indeed, the same maker was often unable to realize his own ideals in practice, making at one time a plow that gave perfect satisfaction, and the next time one that was very inferior. Thus, Arthur Young tells us in his agricultural report of Suffolk, that "a very ingenious blacksmith of the name of Brand" made a plow of iron, of which he says "there is no other in the kingdom equal to it;" and yet when he died no one else could make them. A drawing of this plow is given in Fig. 17.

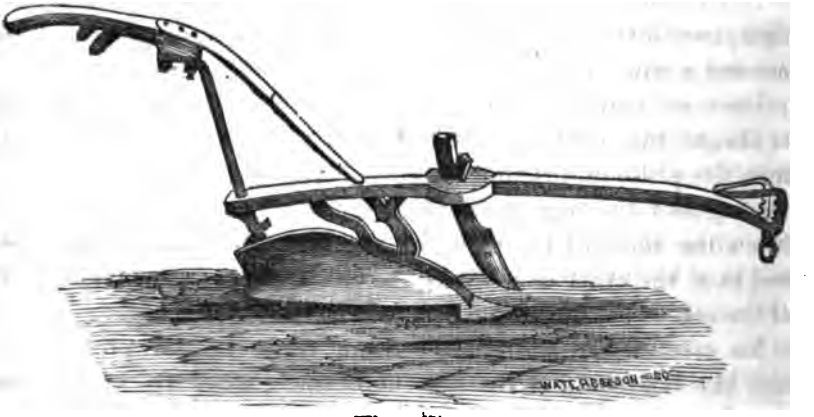

Fig. 17.

It was usual for the farmer to purchase the wooden part of his plow of a mechanic called the plow-wright, which he afterwards had ironed by a blacksmith. Neither of these men paid any regard to the views of the other; the plow-wright made his part according to the counsel of his own will, while the blacksmith adhered to his own notions without the slightest reference to the plans of the plow-wright. The result was an implement, as a

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whole, which had no unity of plan, and the discordant parts could not, therefore, be expected to accomplish satisfactory results.

In view of these great difficulties in the way of making uniformly good plows, it must be admitted that the discovery of Mr. Jefferson, by which mould-boards could be made by any one with the absolute certainty of having them all exactly alike, was an era in agriculture, and the root of all real progress in the manufacture of this all-important implement.

We have therefore thought that it would be desirable to give a full description of his method, which we hope will prove intelligible to every one who desires to understand it.

In order to obtain a clear idea of the curve of the mould-board which Mr. Jefferson considered to be the best, we give his ideas in his own words, except that we shall take the liberty of changing the antiquated names given by him, for those which are used to designate those parts at the present day:

"The mould-board of the plow ought not only to be the continuation of the shield of the share beginning at its posterior edge, but it must also be in the same plane. Its first function is to receive horizontally from the sock the earth, to raise it to the height proper for being turned over; to present, in its passage, the *least possible resistance*, and consequently to require the minimum of moving power. Were its function confined to this, the wedge would present, no doubt, the properest form for practice; but the object is also to turn over the sod of earth. One of the edges of the mould-board ought then to have no elevation, to avoid an useless wasting of force; the other edge ought, on the contrary, to go on ascending until it has passed the perpendicular, in order that the sod may be inverted by its own weight; and the inclination of the mould-board must increase gradually from the moment that it has received the sod.

"In this second function the mould-board then acts like a wedge situated in an oblique direction, or ascending, the point of which recedes horizontally on the earth, while the other end continues to rise till it passes the perpendicular. Or, to consider it under another point of view, let us place on the ground a wedge, the breadth of which is equal to that of the share of the plow, and which in length is equal to the share from the wing to the posterior extremity, and the height of the heel is equal to the height of the rear of the share above the sole: draw a diagonal on the upper surface from the left angle of the point to the angle on the

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right of the upper part of the heel; slope the face by making it bevel from the diagonal to the right edge which touches the earth: this half will evidently be the properest form for discharging the required functions, namely, to remove and turn over gradually the sod, and with the least force possible. If the left of the diagonal be sloped in the same manner, that is to say, if we suppose a straight line, the length of which is equal at least to that of the wedge, applied on the face already sloped, and moving backwards parallel to itself and to the two ends of the wedge, at the same time that its lower end keeps itself always along the lower end of the right face, the result will be a curved surface, the essential character of which is, that it will be a combination of the principle of the wedge, considered according to two directions, which cross each other, and will give what we require, a mould-board presenting the least possible resistance. This mould-board, besides, is attended with the valuable advantage that it can be made by any common workman by a process so exact that its form will not vary the thickness of an hair. One of the great faults of this essential part of the plow is the want of precision, because workmen having no other guide than the eye, scarcely two of them are similar. One may easily conceive and render sensible the manner in which the sod is raised on the mould-board which we have described, by an attentive consideration of the following diagram, Fig. 18.

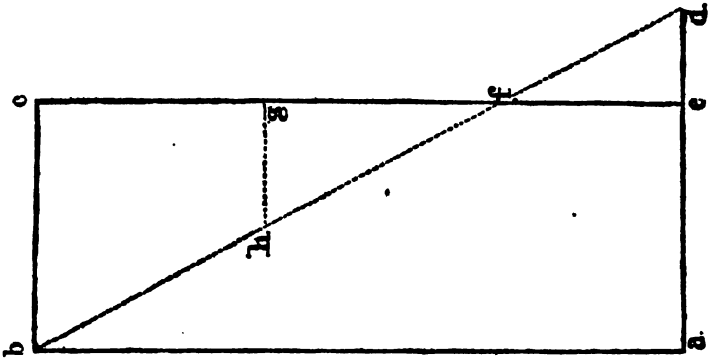

Fig. 18.

Draw on an horizontal plane or parallelogram, *a b c f e*, the lines *a b* and *c e*, being each = to twenty-four inches, = the length of the mould-board, and the lines *b c*, *d e*, each = nine inches, = the width of the sole at the heel of the plow, produce the line *a e* to *d*, and make *e d* four and a half inches, this being the overhang

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of the rear end of the mould-board beyond the perpendicular which Mr. Jefferson thought the most convenient length in practice.

At the point *d* erect a straight stick twelve inches long, which is twice the depth of the proposed furrow; then from the point *b* stretch a string tightly to the top of the stick at *d*. When this is done, take a straight edge twelve inches long, and placing it on *b c*, where it will rest horizontally and will coincide with the plane of the parallelogram, move it backwards towards the line *a d*, keeping the point of the edge which was at first coincident with the point *c* along the line *c e*, and always preserving the parallelism of the edge with the vertical plane of *b c*, it is evident that as the edge resting on the diagonal *b d* moves backwards, the end which at first coincided with *b* will rise upward, and every successive removal towards the line *a d* it will assume a larger angle with the horizontal plane. When the end which was at *c* arrives at the point *g*, and the corresponding part of the edge is on the string at *h*, the line *g h* will form an angle of forty-five degrees with the horizontal plane. When the end of the stick stands on the point *f*, and the edge coincides with *f* on the string, the stick will be exactly perpendicular to the plane: passing on in the line *f e*, towards *a d*, the angles will assume an opposite direction, so that when the end of the moving stick rests upon *e*, and the edge rests on the string at *d*, it will make an angle with the plane of 110½ degrees. When the path of the straight edge from *b c* to *e d* is attentively considered, it is evident that it will have described a curved surface, which is the ideal of what we seek to reproduce in wood.

Let us assume that the depth of the furrow is six inches, its width nine inches, and the length of the mould-board two feet, these figures will decide the size of the block from which the mould-board must be cut.

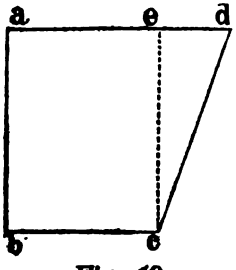

Fig. 19.

The transverse section of the block, Fig. 19, will then be nine inches at the base *b c*, thirteen and a half inches at its summit *a d*, and twelve inches at the side *a b*. The line *b c* must be nine inches, because hat is the width of the furrow. The line *a b* is placed at twelve inches, because Mr. Jefferson found that unless the height of the mould-board was twice as great as the furrow (which we

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have assumed to be six inches), the earth, when the soil was friable and sandy, would rise up over the edge of the mould-board like waves, and fill the furrow behind the plow. It will be seen, however, since in the progress of discovery we have obtained a much better form of mould-board, there is no necessity for this great excess of height. The line *a d* is taken at thirteen and a half inches, because in his opinion it was essential for the rear end of the mould-board to project four and a half inches beyond the perpendicular, in order to make the sod fall on to the preceding slice by its own gravity. It is possible that this amount of inclination from the perpendicular would be sufficient to effect the object on level land, but it requires a much greater lateral projec tion to make the sod fall properly when the furrow is turned up hill. Mr. Jefferson's line of inclination is twenty and one-half degrees; modern practice, founded on the necessity of the case, gives an inclination not less than forty-five degrees.

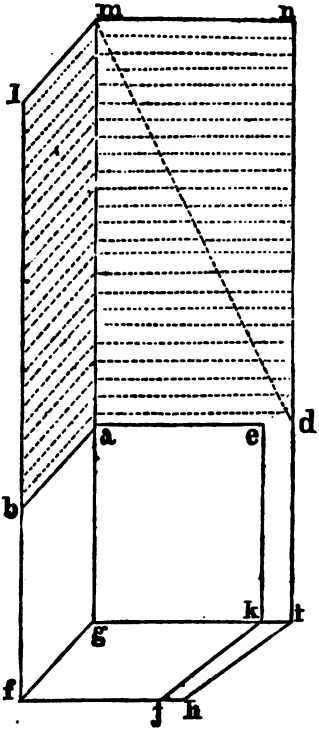

Fig. 20.

A block having a transverse section, as in Fig. 19, and three feet long, is taken and smoothly planed on all its sides. This block is represented in Fig. 20. The first operation consists in forming the tail, by which the mould board is affixed to the stilt or handle, by sawing across from *a* to *b*, on its left side, and at the distance of twelve inches from the end, *f g;* continue the cut perpendicularly along *a e*, until the edge of the saw comes to a line one and a half inches above the side *n i;* then taking *k i*, *j h*, each equal to one and a half inches, and saw across the line *j k*, along the line *k e*, parallel to the right side. The piece *b a e k j f g* will fall of itself and leave the tail, *k e d i h j*, an inch and a half in thickness. It is of the anterior part, *b a e d l m n*, that the mould-board must be formed.

By means of a square, trace out on all the faces of the block, lines at an inch distance from each other, of which there will

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necessarily be twenty-three; then draw the diagonals, *m d*, Fig. 21, on the upper face, and *d o* on that which is situated on the right; make the saw enter at the point *m*, directing it towards *d*, and making it descend along the line *m l*, until it marks out a straight line between *d* and *l*, Fig. 22. Then make the saw enter at the point *o*, and preserving the direction *o d*, make it descend along the line *o l*, until it meets with the central diagonal, *d l*, which had been formed by the first cut; the pyramid, *m n o l d*, Fig. 23, will drop out by itself and leave the block in the form represented by Fig. 22.

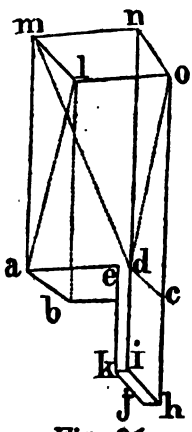

Fig. 21.

It is here to be observed, that in the last operation, instead of stopping the saw at the central diagonal, *d l*, if we had continued to notch the block, keeping on the same plane, the wedge *l m n o d a*, Fig. 21, would have been taken away, and there would have remained another wedge, *l o d a b c*, which, as was observed before, in speaking of the principle in regard to the construction of the mould-board, would exhibit the most perfect form, were the only object to raise the sod; but as it must also be turned over, the left half of the upper wedge has been preserved, in order to continue on the same side the bevel to be formed on the right half of the lower wedge.

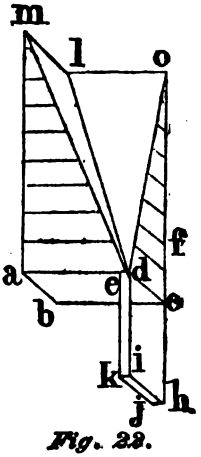

Fig. 22.

Let us now proceed to lay down the means of producing this bevel; in order to obtain which we had the precaution to trace out lines around the block before we removed the pyramid, Fig. 23. Care must be taken not to confound these lines, now that they are separated by the vacuity left by the removal of that pyramid, Fig. 22.

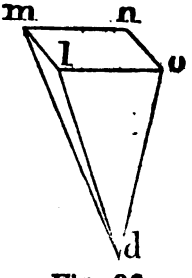

Fig. 23.

Bearing in mind that the line *a d* is thirteen and a half inches in length, the line *a b* is twelve inches, the line *b c* or *l o* is nine inches in length and that the line *d c* slopes downward and inward towards the left hand, as shown in Fig. 19. We make the saw enter in the two points of the first dotted line situated nearest to

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m and *o*, Fig. 22, and on the diagonals *m d* and *o d*, continuing the stroke on that first line till it reach on the one hand the central diagonal *d l*, and on the other the lower right edge, *o h*, of the block, Fig. 22; the posterior end of the saw will come out at some point situated on the upper trace in a straight line with the corresponding points of the edge and the central diagonal. Continue to do the same thing on all the points formed by the intersection of the exterior diagonals and lines traced out around the block, taking always the central diagonal and the edge *o h*, as the term and the traces as directors; the result will be, that when you have formed several cuts with the saw, the end of that instrument, which came out before at the upper face of the block, will come out at the face situated on the left of the latter; and all these different cuts of the saw will have marked out as many straight lines, which, extending from the lower edge, *o h*, of the block, will proceed to cut the central diagonal. Now, by the help of any proper tool, remove the sawn parts, taking care to leave visible the traces of the saw, and this face of the mould-board will be finished.

An attentive consideration of the processes which have been gone through with the block, Fig. 22, will show that they are precisely equivalent to those described in elucidating Fig. 18; the diagonal, *d l*, in the first, corresponds with the diagonal *b d* in the second, and the line *o h* in the one corresponds with the line *c e* in the other.

It must not be forgotten that the point *d* overhangs the point *c* four and a half inches towards the right; hence there will be a point in the line *o h*, at *f*, which will be exactly vertical on the diagonal *d l*, it is obvious that in sawing the traces bewteen *f* and *o*, the point of the saw will be directed upward and forward towards the line *a m*. At *f* it will be directed vertically upward, and after it passes the point *f*, towards *c*, it will be directed downwards and backwards towards the line *b l*; the saw marks which are left on the face of the mould-board are the representatives of the successive positions of the twelve-inch stick as it was progressively moved backward in a line parallel to itself from *c* towards *e*, in Fig. 18.

It now remains to construct the opposite side of the mould-board so as to be parallel at all points with the face. Invert the block, and make the saw enter at the points where the line *b l*, Fig. 24, meets with the traces, and remembering that the side,

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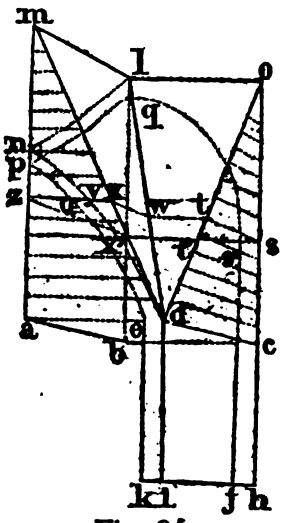

Fig. 24.

a b m l, which in Fig. 22 laid vertically and to the left of the block, now lies downwards on its face, while the side of the wedge *a d m* (*a d* being thirteen and a half inches) now lies vertically and is on the left side of the block; now continue the stroke along these traces until both ends of the saw approach within an inch, or any other convenient distance of the finished face of the mould-board. When each of the traces have been thus sawn through, remove the sawn parts with some convenient tool, as before, and the mould-board is finished.

Any one who will have the patience to fix in his mind carefully the line left by the saw when its posterior end rests in the line *o h*, and its anterior end on the diagonal *d l*, through each of the twenty-three traces made upon the block, will be enabled to conceive of the exact twist of the surface of the mould-board; yet as some minds have a difficulty in realizing such warped surfaces, we give another method which may be more clear to such readers.

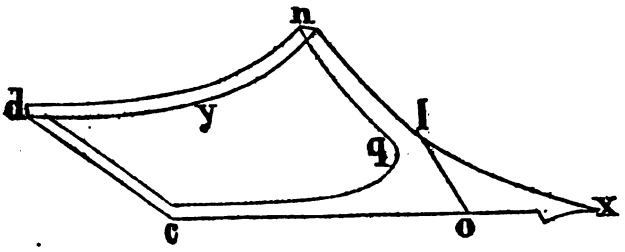

Fig. 25.

Suppose the saw cuts the lines *m d* and *o d*, Fig. 24, in the points *x* and *t*, in the traces *x z* and *t s*, parallel to *a b b o*, and the prolongations of which on the triangles *m d l* and *l d o* are the lines *x w* and *t w;* the saw must then penetrate the block, remaining in the same plane in question, until its point has reached the point *s*, and at the same time touch the point *w* of the central diagonal *d l*. The fore end of the saw will come out at some point, *y*, of the face *a m d*, so that three points, *s w y*, will be in the same straight line. But if this operation be repeated in different places of the lines, *m d* and *o d*, bringing the edge down

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along the traces to the line *o h*, at the rear, and the line *d l*, in front, the fore part of the saw will come out on the face, *a m d*, as we go on towards *c*, at constantly varying elevations above the line *a m*. If we now connect the points thus made by the saw on the face, *a m d*, the line traced between them will be the line *r y d*, Figs. 24 and 25. Beyond this height the saw, directed in the same manner, will come out at other points situated on the posterior face, *a b m l*, and a line connecting these points, as before, will form the second of these curves on both figs., *n, l*, which will meet the first in the point *n*.

These two curves being traced out, let us suppose straight lines drawn to the places where the saw stopped each time that it touched the diagonal, *d l*, and of which one, as already said, passes through the points *s w y;* and let us conceive a surface touching all these straight lines, and whose limits, on the one hand, shall be the curves *d y n*, *l n*, and on the other the line *o h*, this surface, which must be uncovered by sections made with a proper instrument, will form one of the faces of the mould-board, which is represented by *d n l o c*, Fig. 25, where *c y* represents the perpendicular and the point *d* curves over towards the spectator four and a half inches beyond the point *c*. The share, *l o x*, has been added to show how the plow looks when finished.

To make the opposite face of the mould-board, the thickness thereof having been determined by the thickness of *d e k i*, Fig. 24, at one and a half inches, let us first conceive that there has been traced out, proceeding from the point *e*, the curve *c u p*, parallel to *d y n*, and then proceeding from the point *p*, the curve *p q*, parallel to *n l*.

Let us next suppose that the saw cuts the edge *b l* of the face *b a m l* in the point *x'*, situated in the same plane as *z x*, *t s*, which plane has been taken, for example, in regard to the anterior face of the mould-board. The saw must be directed along the traces *x' z* and *x' s*, in such a manner that its motion shall stop at the term where its edge, on the one hand, shall touch the curve *e p*, in the point *u*, situated on the trace *x z*, and, on the other, shall be situated parallel to the line *s w y*, at which the saw stopped on the other side of the mould-board. The edge of the saw will then cut the face of *b l o c*, in some point *t'*, so situated that the straight line drawn through that point and the point *u*, shall be parallel to the straight line which passes through the point *s w y*. If you continue cutting in the same manner, with the saw, differ-

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ent points of the edge *b l*, those by which it comes out will form, on the face *b l o c*, a curve *j s q;* and if, through these points and those corresponding to them in the lines *e p* and *p q*, there will be drawn straight lines, such as that which passes through *z* and *u*, which we have taken as an example, the surface touching these straight lines, and, uncovered by means of any sharp instrument, will form the remainder of *j h o l q t'* of the plane *b l o c*, being the opposite side of the mould-board.

It is fixed to the plow by mortising the fore part, *o l*, Fig. 25, into the posterior end of the share, which must be made double, like the handle of a pocket comb, that it may receive and secure this fore part of the mould-board. A screw nail is then made to pass through the mould-board and the handle of the share at the place of their contact, and two other screw nails pass through the tail of the mould-board and the right handle of the plow. The part of the tail which passes beyond the handle must be cut diagonally, and the work will be finished.

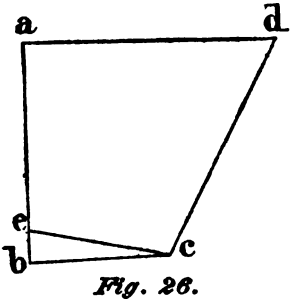

Fig. 26.

We have thus given the plan of forming the mould-board in full detail, so that the principle of its construction may be clearly understood; but Mr. Jefferson found, in actual practice, that some modifications of it might be usefully made. Thus, he says: "Instead of beginning to form the block as represented by *a b c d*, Fig. 26, where *a b* is twelve inches in length, and the angle at *b* is a right one, I cut off towards the bottom and along the whole length, *b c*, of the block a wedge, *b c e*, the line *e b* being equal to the thickness of the bar of the share (which I suppose to be one and a half inches); for, as the face of the wing inclines from the bar to the ground, if the block were placed on the share, without taking into the account this inclination, the side *a b* would lose its perpendicular direction, and the side *a d* would cease to be horizontal. Besides, instead of leaving at the top of the block a breadth of thirteen and a half inches from *m* to *n*, I remove from the right side a kind of wedge, *n d i c p*, of one and a half inches in thickness, Fig. 27; because experience has

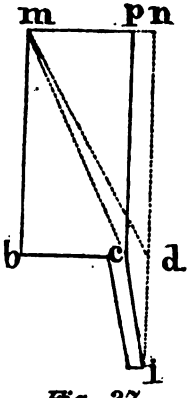

Fig. 27.

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shown me that the tail which, by these means, has become more oblique, as *c i*, instead of *d i*, fits more conveniently to the side of the handle; the diagonal of the upper face is consequently removed back from *a* to *c*, and we have *m c*, instead of *m d*, as above. These modifications may be easily comprehended by those acquainted with the general principle."

This method, devised by Mr. Jefferson, removing, as it does, the formation of the plow out of the domain of empiricism, and enabling workmen in different sections of the country, without communicating with each other, to form their mould-boards precisely alike, was one of the most valuable contributions towards the perfecting of plows that has ever been made by any one man, and will always entitle him to a conspicuous place among the benefactors of agriculture.

But the credit that we award to him must be confined to the service which he rendered in demonstrating that plows *could* be made by rule, and to the actual discovery of *one* of the many rules that are applicable to the formation of the mould-board.

A very slight examination of Mr. Jefferson's method will show its very great defects. For instance, the overhang of the wing to the right, *e d*, Fig. 19, is only four and one-half inches. This would only be sufficient to turn the furrow slice, when it was turned down hill, or, on some soils, it would answer on a level, but, on other soils, it would be quite insufficient to invert the slice, while it would be sure to tumble back into its original position when the furrow was turned up the hill. Modern practice shows that no plow can be safely relied on to invert the furrow where the overhang is less than forty-five degrees.

To make this angle, the line *e d*, Fig. 18, must be made twelve inches instead of four and a half inches. Then, to complete the plow, according to Mr. Jefferson's rule, the perpendicular *f* would be advanced six inches towards *c*, and the line *g h* would be carried forward, so that it would stand within five and a quarter inches of the point *c*. It will be very obvious that such a degree of bluntness would be impracticable without an expenditure of power which no farmer could afford to throw away. In other words, the rule is only applicable when we have an impracticable rear wing to the mould-board or an impracticable share.

The lower edge of the mould-board is quite too long, increasing the friction very unnecessarily. In our best modern plows the

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vertical sections of the mould-board are either concave or convex, according as the soil is too light or too stiff. The vertical sections of Mr. Jefferson's would be all rectilinear, which are not as favorable for good and easy plowing as curves.

The straight diagonal line, *m d*, used as the generator of Mr. Jefferson's twisted surface, should have been a curve instead of a straight line.

The reception of the front edge of the mould-board into a cavity in the posterior edge of the share, and secured by a single screw nail, suggests great weakness where great strength is required. The connection of the tail of the mould-board with the handle, by two screw nails, is quite too weak a connection, and would of itself condemn the plow in modern markets.

Mr. Jefferson seems to have confined his attention solely to the mould-board, overlooking the sole, the land side, the position of the beam and cutter, with reference to the plane of the land side altogether. It will be seen, as we advance, that these points are all of radical importance, and that no perfection of the mould-board can compensate for their defects.

At the conclusion of his paper he says that, having satisfied himself that the plan that he has laid down is the best, he proposes in future to have his mould-boards made of cast iron. This is the first allusion that we have met with in an American author to the use of cast iron for the plow. If we are correct in this, it adds greatly to his credit.

The first of any idea, on Mr. Jefferson's part, of improving the plow, which Mr. Randall finds among his papers, is contained in his journal of a tour in Germany, made in the year 1788, when he was American Ambassador in France. In passing through Lorraine, along the banks of the Meurthe, he frequently alighted to observe the teams and the implements of the farmers who were engaged in plowing by the wayside. Some of the plows thus examined were more remote from the improved forms of the present day than those traced in the hieroglyphics of early Egypt. Stopping for a night at Nancy, the capital of the ancient dutchy, he made an entry in his journal, from which the following is an extract: "Oxen plow here with collars and hames. The awkward figure of their mould-boards leads one to consider what should be its form. The offices of the mould-board are to receive the sod after the share has cut under it, to raise it gradually and

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to reverse it. The fore end of it should therefore be horizontal, to enter under the sod, and the hind end perpendicular, to throw it over; the intermediate surface changing gradually from the horizontal to the perpendicular. It should be as wide as the furrow, and of a length suited to the construction of the plow." He then gives diagrams and descriptions, which have already been described in detail. The entries in the journal show that the whole plan was at that time clearly developed in his mind.

When he resided in Philadelphia, as Secretary of State under General Washington, he consulted the celebrated David Rittenhouse as to whether his proposed plow was founded on mathematical principles, and Mr. Rittenhouse, after a careful examination of the whole question, made that fact demonstrable.

In 1793 Mr. Jefferson, as we are informed by Mr. Randall, put his theory to the test of practical experiment. He had several plows made after his patterns, and put into use on his estates, in Albemarle and Bedford counties, in Virginia, and became fully satisfied of their practical utility.

Mr. Strickland, a member of the English board of agriculture, travelled in this country and saw these plows in operation. Being much pleased with their operation, he took home drawings of them, which he submitted to his associates in the board. They were so highly approved that Jefferson was elected as an honorary member of the board, and was requested by Sir John Sinclair, its president, to forward a model and a full description of his invention. Mr. Jefferson complied with his request, and the letter to Sir John was printed in the Edinburgh Encyclopedia, from which we have compiled the preceding account of his invention.

The originality of Mr. Jefferson's discovery was contested by William Amos, in a communication published in 1808, but he gives no proofs of it, and Mr. Jefferson certainly was not foolish enough to present his method as original to two learned societies, who had the means of at once detecting the imposture. The fact that these bodies, the French Academy and the English Board of Agriculture, acknowledged the invention to be his own, must forever set the question at rest.

The discovery has also been claimed for James Small, but Sir John Sinclair distinctly states that Small perfected his plow gradually and experimentally, and without the assistance of the key which Mr. Jefferson's principle would have given him. His im-

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provements were empirical, and were not at first guided by any mathematical principles whatever. There can be no doubt whatever that Mr. Jefferson is solely entitled to the honor of inventing the first mould-board made on mathematical principles. We have inserted this account of Mr. Jefferson's discovery in the chapter on European plows, because his method was first published in Europe.

CHAPTER III.

HISTORY OF THE PLOW—CONTINUED.

The celebrated James Small, of Scotland, was the next great improver of the theory and practice of plow-making. He was the first inventor of the cast-iron plow, though the beam and handle were still made of wood. He took the Rotherham plow as the basis, and improved it in almost every particular.

He established his manufactory at Black Adder Mount, in Berwickshire, in 1763, and died about thirty years afterwards; having distinguished nearly every one of those years by some new improvement in some of the parts. He left the implement at his death so nearly perfect that to this day it is used in many of the largest and best cultivated districts in Scotland, and prized more highly than any other. The cut, showing Small's chain plow, Fig. 28, gives his first efforts to improve the Rotherham plow, which will be readily seen on a comparison of the drawings representing them.

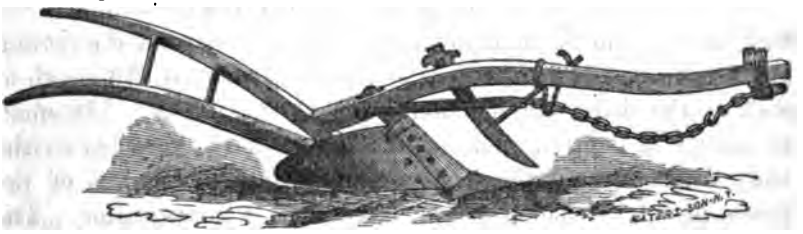

Fig. 28.

The plow as finally perfected by Small, and generally known as the EAST LOTHIAN PLOW, has attained to so high a degree of celebrity, and proved itself so advantageous to farmers, that we propose to give its details very fully, from Stephens' Book of the Farm.

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Plate II, fig. 49, represents an elevation of the plow on the furrow side, drawn to a scale of one inch to a foot, and Fig. 50, a horizontal plan of the same. It is found with various shades of difference, but not to the extent or of such marked character as to require separate description from what follows. The beam and handles are almost invariably made of malleable iron, the body frame being of cast iron, the latter varying slightly with different makers. In its construction the beam and left handle are usually finished in one continued bar, A B C, possessing the varied curvature exhibited in Fig. 49, as viewed in elevation. When viewed in plan, as in Fig. 50, the axis or central line of the beam and *left handle* are in a straight line, though in this arrangement there are some slight deviations among the different makers—the point of the beam being in some cases turned more or less to the right or furrow side, and this is found to vary from one-half inch to two inches from the plane of the land side. The *right* handle, D E, is formed on a separate bar, and is attached to the body frame at its fore end by a bolt, as will be shown in detail, and farther connected to the left handle by the bolts F F F and the stays G G. The *coulter*, I, is fixed in its box, K, by means of iron wedges holding it in the proper position. Its office being that of a cutting instrument, it is constructed with a sharp edge, and is set at an angle of from 55 deg. to 65 deg. with the base line. The *mould-board*, L, which is fixed upon the body frame and to the right handle, is a curved plate of cast iron, adapted for turning over the furrow slice. Its fore edge or breast, M N, coincides with the land side of the plow's body; its lower edge, T, behind, stands from nine to ten inches distant from the plane of the land side, while its upper edge, P, spreads out to a distance of nineteen inches from B, the land side plane. In this plow the mould-board is truncated in the fore part, and is met by the gorge or neck of the share, the junction being at the line N. The *share* or *sock*, N R, is fitted upon a prolongation of the sole bar of the body frame termed the head, and falls into the curves of the mould-board, of which its surface forms a continuation. The *bridle*, C, or muzzle, as it is sometimes named, is that part to which the draught is applied, and is attached to the point of the beam by two bolts, the one, S, being permanent, upon which the bridle turns vertically. The other bolt, U, is movable, for the purpose of varying the *earthing* of the plow; the *landing* being varied by shifting the draught bolt and shackle, V, to right

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or left. The right and left handles are furnished at A and D with wooden helves, fitted into the sockets of the handles. If any one will take the trouble to compare the means employed in Jethro Tull's plow, Plate I, to make the plow run deeper or shallower, more to land or from land, with the arrangements for this purpose in the Rotherham plow, Fig. 16, they will see that a great advance has been made, but an inspection of Small's bridle, as shown in the plate, will demonstrate that much more convenience and certainty has been attained by him in this respect, and nothing since has been invented to accomplish this object which can be pronounced materially superior to it.

The *general dimensions* of this plow may be stated thus, as measured on the base line: From the zero point, O, to the extremity of the heel, T, the distance is four inches, and from O forwards to the point of the share, R, the distance is thirty-two inches—giving as the entire length of the sole, three feet. Again, from O backward to the extremity of the handles, A′, is six feet two inches, and forward to the draught bolt, V′, four feet seven inches, making the entire length of the plow on the base line ten feet nine inches; but, following the sinuosities of the beam and handle, the entire length from A to C is about eleven feet three inches. Although we have explained the word zero, used above, in the chapter "On the Mechanical Conditions of the Plow," yet, as it is a point of great importance in regulating the proportions of the implement, and has received very little attention from American plow makers, we here observe that the zero *line* is that which, on the surface of the mould-board, where a vertical transverse section at right angles to the plane of the land side falls, which is distant from that plane by a space equal to the greatest breadth of the furrow taken by the respective plows. The zero *point* is found on this line, at an altitude above the sole the exact height of the furrow slice. Or we may define it as that vertical section of the mould-board which, in its progress under the slice, will just touch the latter when in a vertical position. The scale in this arrangement counts right and left of zero.

In reference to the body of the plow, the center of the coulter box, K, is fourteen and a half inches, and the top of the breast curve, M, nine inches before the zero point, both as measured on the base line; but, following the rise of the beam, the distance from M to the middle of the coulter box will be seven inches.

The *heights* at the different points above the base line are

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marked on the figure in elevation, along the upper edge of the beam and handle; but the chief points in height are repeated here, the whole of them being measured from the base line to the upper edge of the beam and handles at the respective points. At the left handle, A, the height is three feet, at the right handle, D, two feet nine inches; and a like difference in the height of the two is preserved till the right handle approaches the body at the middle stretcher, F; thence the difference increases till it reaches the body. The height at the point of the beam is eighteen inches, and the centre of the draught bolt, at a medium, seventeen inches. The lower edge of the mould-board behind, of this plow at T, is usually set about half an inch above the base line, and at the junction with the share about the same height.

The dimensions in *breadth*, from the land side line, embrace the obliquity that is given to the direction of the beam and handles, compared with the land side plane of the body taken at the sole. The amount of obliquity, as exhibited by the dotted line, A C, Fig. 50, which coincides with the land side plane of the body, is that the axis of the beam at the extremity C stands one and a quarter inches to the right, and, at the opposite end, the left handle, A, stands about two inches to the left of the line. These points may, however, be raised slightly from the dimensions here given. In the first—the point of the beam—it is found in the practice of different makers to range from one to two inches.

The dimensions of the parts of the frame work of the plow are: The beam, at its junction with the mould-board at M, is from two and a half to two and three-quarter inches in depth, by one inch in breadth—the same strength being preserved onward to the coulter box, K. From the last point a diminution in breadth and depth begins, which is carried on to the extremity, *c*, where the beam has a depth of one and three-quarter inches, and a breadth of one-half to five-eighths of an inch.

The coulter box is formed by piercing an oblong mortise through the bar, which has been previously forged with a protuberance at this place, on each side and at the upper edge; the mortise is two and one-half inches by three-quarters of an inch.

From the junction with the mould-board at M, backward, the beam decreases gradually till, at the hind palm of the body at B, it is two inches in depth and five-eighths of an inch in breadth where it merges in the left handle, A. This last member retains a nearly uniform size throughout of two inches by three-eighths

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of an inch. The right handle, D, is somewhat lighter, being usually one and one-half inches by three-eighths of an inch, and both terminate in welded sockets which receive wooden helves of six or eight inches in length. The stretchers, F F F, which support and retain the handles at their due distance apart, are in length suited to their positions in the handles, and their thickness is about three-quarters of an inch in diameter, tapering toward the ends, where they terminate in a collar and tail bolt with a screwed nut. The upper stretcher has also a semicircular stay riveted to its middle, the tails of the stays, G G, terminating, like the stretcher, with screwed tails and nuts.

Having given the general dimensions and outline description of this plow, there remains to be described the *details of the body frame* and its sheathing, all the figures of which are on a scale of one and one-half inches to one foot.

The Body Frame.—The different views of the body frame are exhibited in the Figs. 29 and 30, wherein the same letters refer to

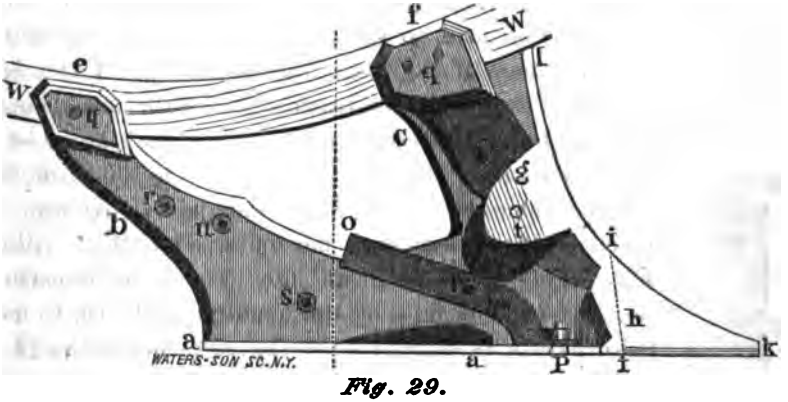

Fig. 29.

the corresponding parts in the different figures. Fig. 29 is an elevation of the furrow side; Fig. 30 a plan of the sole bar of the frame inverted; and a vertical section on the line X X is given in

Fig. 30.

Fig. 31. In all the figures, then, *a a a* is the sole bar, with two arms, *b* and *c*, extending upwards, and having at the lower edge a flange, *d*, running along the right hand side. Each of the arms,

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b, *c*, terminates in a palm, *e f*, by which it is bolted to the beam. The arm, *c*, is furnished, besides, with an oblique palm or ear, *g*, upon which the fore edge of the mould-board rests and to which it is bolted. The sole bar, *a*, with its flange, terminates forward in the head, *h*, which is here made to form the commencement of the twist of the mould-board, and upon which the share is fitted, reaching to the dotted line, *i i*, Fig. 29. The fore edge, *k i l*, of the frame is worked into the curve, answering to the oblique section of the fore edge or breast of the mould-board, and serves as a support to the latter throughout their junction. The curvature given to the arm, *b*, is unimportant to the action of the plow, but the general oblique direction here given to it is well adapted to withstand the thrust constantly exerted in that direction when the plow is at work. In Fig. 30, the sloping edge, *d m*, represents the enlargement of the sole bar on which the share is fitted and where the lower part of the fore edge of the mould-board rests. The depressed portion, *m n*, is that which is embraced by the flange of the share. In the frame, *o*, is the lower extremity of the right handle broken off at *o*, to show the manner in which it is joined to the sole flange of the frame by the bolt, *p*. The bolt holes, *q q*, are those by which the beam is secured to the palms of the frame; *r r* are those by which the land side plate is attached, and *s s* those of the sole shoe, *t*, being that which secures the mould-board to the ear, and *u* that which receives the lower stretcher of the handles. (See Fig. 50, Plate II, at F and O.) The letter *v* marks the second bolt hole of the mould-board, while its third fixture is effected upon the right handle by the intervention of a bracket, or of a bolt and socket as seen at *o*, Plate II. The curved lines, *w w*, mark the position of the beam when attached to the body, the beam being received into the seats formed on the land side of the palms, *e*, *f*, as seen more distinctly at *w* in Fig. 31.

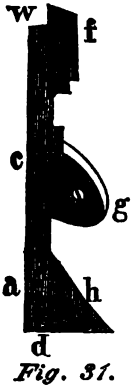

Fig. 31.

The body frame being an important member of the implement, regard is paid to having it as light as may be consistent with a due degree of strength; hence, in the different parts breadth has been given them in the direction of the strain, while the thickness is studiously attenuated in such places as can be reduced with safety. The least breadth of the sole bar, *a*, is three and three-quarter inches, of the arm, *c*, four and one-half inches, and of *b*,

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two and one-quarter inches. The breadth of the sole flange is two inches, the greatest thickness in any of the parts is three-quarters of an inch, and the total weight of the frame is thirty pounds.

The Share.—Figs. 32 to 37 are illustrations of the share and its configuration; Fig. 32 is a plan; Fig. 33 a geometrical eleva-

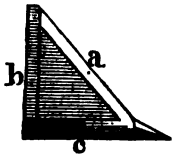

Fig. 34-35.

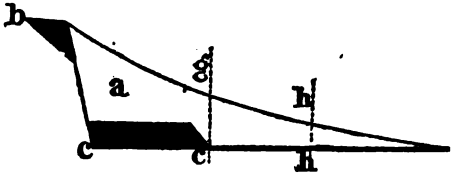

Fig. 33.

Fig. 36.

Fig. 37.

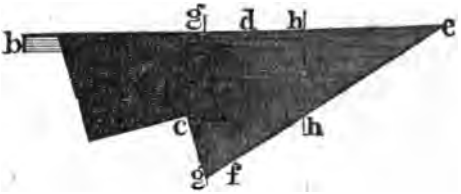

Fig. 32.

tion of the furrow side, and Fig. 34 is a direct end view looking forward, of which *a* is the *boss* adapted to the curvature of the mould-board; *b*, the land side flange, which embraces the head of the land side; *c*, the sole flange, embracing in like manner the head below; and these three parts form the neck or socket of the share, fitting closely upon the head, and being in effect part of the mould-board. The part *d e f*, Fig. 32, forms the share proper, consisting of *d c e*, the *shield* terminating in the point *e*, and of the *feather* or *cutter* running off at the point *e*. The extreme *breadth* of the share in this plow, measuring from the land side to the point *g* of the feather (or the *rear angle of the feather*), varies from six to six and one-half inches; and its *length* in the sole, including the neck, *b*, is about sixteen inches, the feather, *g e*, being eleven inches.

The other figures, 36 and 37, are transverse sections of the share on the lines *g g* and *h h*, respectively, exhibiting the structure and relation of the shield, and the feather represented by the line A′ V′, Fig. 49, Plate II, where, as will be observed, the cutting edge, through its entire length, lies within less than one-quarter of an inch of the base line.

The share is of wrought iron, and is always formed from a

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plate forged for the express purpose at the iron mills, and known in the trade by the term sock plate. Fig. 38 represents the form in which those plates are manufactured, the thickness being from one-half to three-quarters of an inch; they are afterwards cut in two through the ine *a b*, each half being capable of forming a share. To do this, an incision, *c a*, is made on the short side to a depth of two inches; the part *a c d e* is afterward folded down to form the sole flange, and the part *b f g* is in like manner folded down to form the land side flange. The point *h* is strengthened, when requisite, to receive the proper form of the shield and point, the latter being tipped with steel. The edge, *h c*, is extended to the requisite breadth to form the feather. In order to cut a sock plate at the proper angle, so as to secure a minimum expenditure of labor and material, let a central line, *h h*, be drawn upon the plate, and bisect this line in the point *k*, the line upon which the plate should be cut will form angles of 70 deg. and 110 deg. nearly with the line *h h*, or mechanically draw *k l* equal to five and one-half inches, at right angles to *h h*, and draw *l i* parallel to *h h*, mark off two inches from *l* to *i*, and through the point *a i k* draw the line *a b*, which is the proper direction in which the plate should be cut.

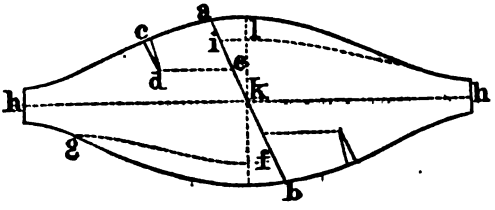

Fig. 38.

The Sole Shoe.—The figures 39 to 41 are illustrative of the sole shoe. Fig. 39 is a plan of the shoe, *a a* being the sole flange, and *b b* the land side flange; Fig. 40 is an elevation of the same, and Fig. 41 a cross section, showing the filling up of the internal angle, opposed to where the greatest wear takes place.

The thickness of the sole flange at the heel *a* is seven-eighths of an inch, diminishing forward to three-eighths of an inch at three inches from the point, and thence it is thinned off to prevent obstruction in its progress through the soil. The breadth of the sole is two and one-quarter inches, and its extreme length twenty and one-half inches. The side flange is one-half of an inch thick along the edge, by which it is attached to the sole, diminishing upward to one-quarter of an inch at the top edge, the height being four and three-quarter inches at the heel, and six inches at the fore end; the weight is about fourteen pounds. The upper

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land side plate is eighteen inches in length on the lower edge, being one and one-half inches longer than the corresponding edge of the sole plate, the purpose of which will be seen in the figure of the land side, Fig. 46; the length of the upper edge is twenty-

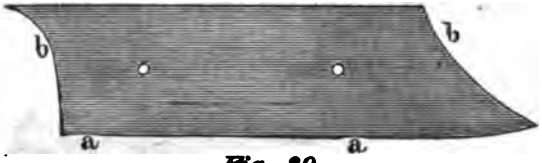

Fig. 39.

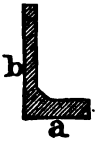

Fig. 41.

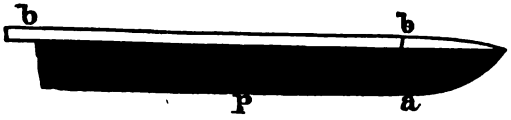

Fig. 40.

one and one-half inches. The breadth and the contour of the upper edge must be adapted to the form that may have been given to the beam. The thickness at the lower edge must agree with that of the sole plate, and be diminished to one-half of an inch at the upper edge; weight, nine pounds.

The coulter, Fig. 42, is an edge, and Fig. 43 a side view of the coulter of this plow, in which the same letters of reference are

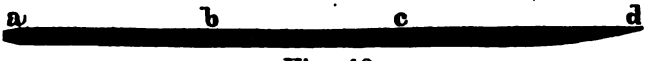

Fig. 42.

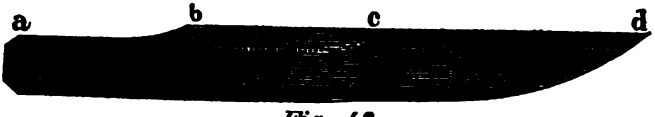

Fig. 43.

applied. The neck *a b*, by which it is affixed in the coulter box, is about ten inches long, though it may, with all propriety, be extended to *c*; the neck is usually about two inches in breadth, and three-quarters of an inch in thickness. The blade *b c d* varies in length, according to the variety of the plow to which it belongs, from eighteen to twenty-two inches. The breadth of the blade is usually about three inches in the upper part, but is curved off behind, and terminating in a point at *d*. The thickness of the back at the shoulder *b* is three-quarters of an inch, and tapers gently downward to where the curvature of the back begins; thence it diminishes toward the point to one-eighth of an inch or less. It is formed quite flat on the land side, and on the furrow

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side is beveled off towards the cutting edge, where it is about one-eighth of an inch thick throughout the length of the edge.

The Bridle.—Fig. 44 is a plan, and Fig. 45 is a corresponding elevation of the bridle, and of the manner of its attachment to the beam, where *a* is part of the beam, *b* the cross head, and *c c* the

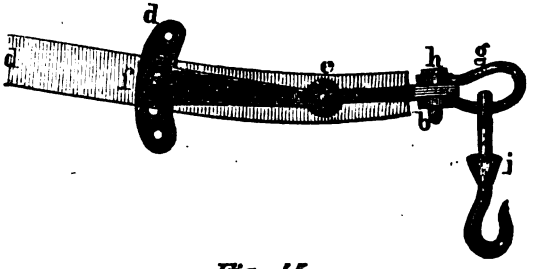

Fig. 45.

Fig. 44.

tails of the bridle, with their arc heads, *d*, embracing the beam on the two sides; *e* is the joint bolt on which the bridle turns for adjustment to earthing; *f* is the temper pin or bolt, and by inserting it into any one of the holes in the arc heads, and passing through the beam, which is here perforated for the purpose, the bridle is held in any required position. The draught shackle *g* is held upon its place upon the cross head *b* by the draught bolt *h* passing through both parts, and the cross head being perforated with five or more holes; the bolt or shackle can be shifted from right to left, or from left to right, for the proper adjustment of the landing of the plow. To the shackle is appended the swivel hook *i*, to which is attached the main draught bar or swingle tree of the yoke.

The Land Side.—Figs. 46 and 47 are illustrations of the land side; Fig. 46 being an elevation of the body of the plow, represented in the working positions, but with the extremities cut off. The point of the share and the heel rest upon the base line at *a* and *b*, and the lines of the sole lying between these form the very obtuse angle, which obtains in the sole of this plow; *a c* is the share, and *d b* is the sole shoe; *e* is the land side plate, and *f g* is a part of the beam. The lines *a d* and *d b*, together with the

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base line, form the very low triangle *a d b*, whose altitude at *d* does not exceed three-eighths of an inch, or by extending the sole line *b d* to *h*, the depression *h a*, of the point of the share below this extended line, will be one-half inch nearly. Fig. 47 repre-

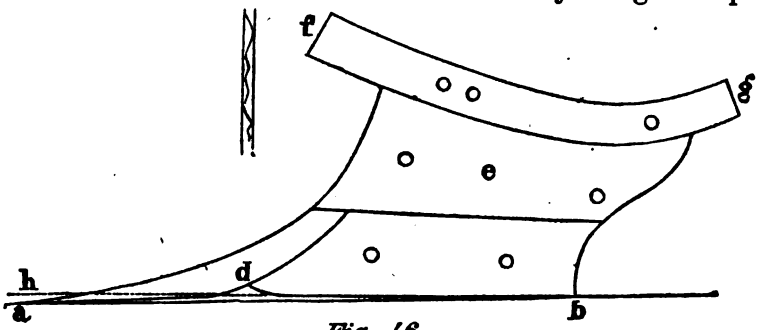

Fig. 46.

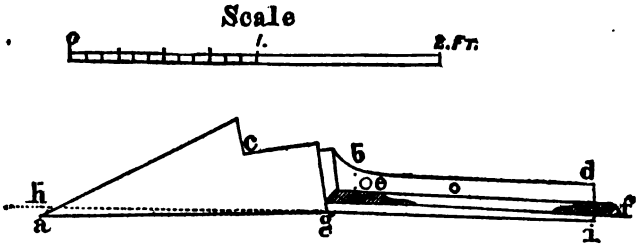

Fig. 47.

sents a horizontal sole shoe. Here *a c* is the share, *b d* is the sole flange of the body frame, the bolt hole at *b* being that by which the palm of the right handle is fixed to the flange; *e* and *f* the two arms of the frame as cut across in the section *g i*, the land side of the sole shoe coinciding with the land side plane; the continuation of this line *g i* to *h* exhibits the inclination of the share to the land side, which, in this plow, may be taken at one-half an inch.

The inclination downward given to the share is intended, and experience confirms the intention, to give steadiness of motion to the implement by giving it a lengthened base on which to stand. It is evident that if a base the converse of this were given to it, convex instead of concave, so that it should rest on the point *d*, when in motion, the smallest obstruction occurring at the point of the share would give it a tendency to swerve from the horizontal line of progression, and to lose either depth of furrow or be thrown out, thus rendering the management of the plow very difficult and uncertain. Even a perfectly straight base is found

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not to give the requisite certainty of action, without a greater amount of exertion, as well as closer attention on the part of the plowman. A like reason prevails for this inclination of the share landward as does for its earthward inclination; and, for the steady motion of the plow, the latter is even more necessary than the former; but there is another reason for this landward inclination, which is that, as the plow is seldom held with the land side truly vertical, but inclining a little landward, and it being desirable to cut the furrow slice, as near as possible, rectangular, the coulter has always a slight tendency landward at the point; hence it becomes necessary to give the share a like bias. By this arrangement of the parts the incision made by the coulter will be nearly vertical. While it is admitted that these inclinations of the share afford certain advantages in the action of the plow, it must not be concealed that the practice is liable to abuse.

The curves of the mould-board of this plow are given at Figs. 111 and 112, Plate III. As plow diagrams in this form are not familiar to farmers and plow-makers in this country, it may be proper to give some explanation of the manner in which they are obtained and the precise lines of the plow which they represent. Fig. 48 represents the instrument by the aid of which these lines

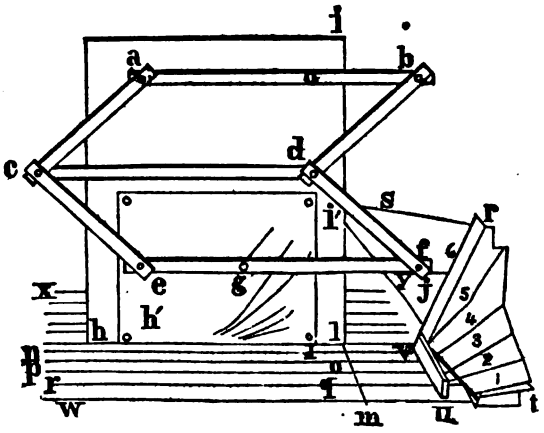

Fig. 48.

are obtained. Lines *q r*, *o p*, etc., are ruled on the horizontal surface two inches apart. The plow to be analyzed is placed upon the table, with the plane of its land side perpendicular to the plane of the table, its sole line at right angles to the ruled lines and the front edge of the mould-board, *t*, on the line *w m u;* draw the line *l m* at right angles to *w m*, making it as long as the mould-board

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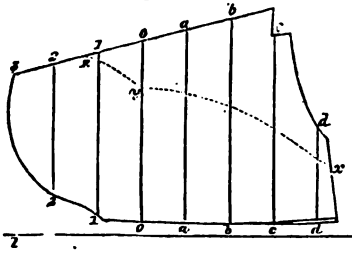
Plate III.

ANALYTICAL SECTIONS OF MOULD-BOARDS.

Fig. 111. *The East Lothian.* Fig. 112.



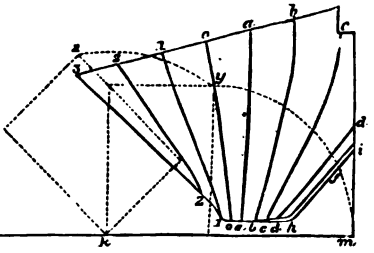
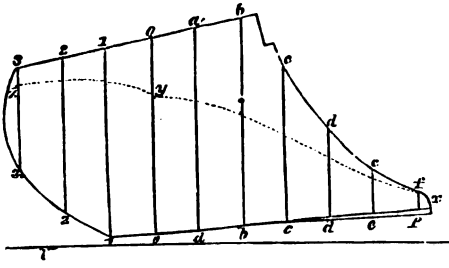


Fig. 113. *The Mid Lothian.* Fig. 114.



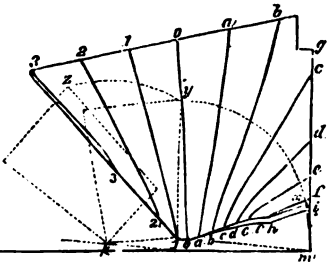
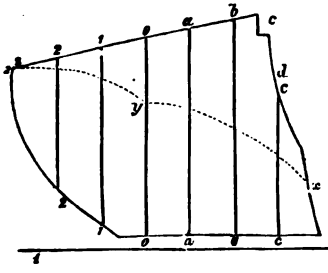


Fig. 115. *The Berwickshire.* Fig. 116.



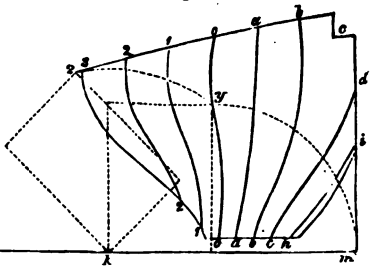
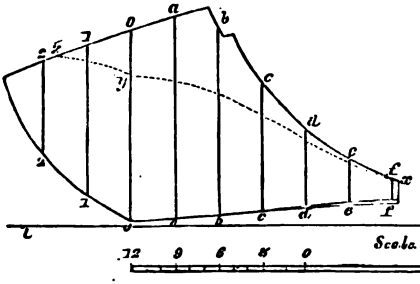
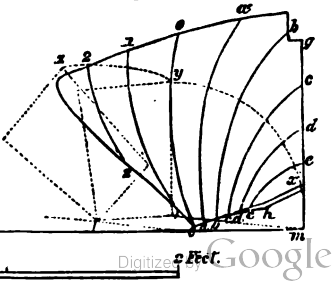


Fig. 117. *The Lanarkshire.* Fig. 118.





Scale.

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2 Feet.

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of the plow; *i h* is a board about three feet square, provided with broad feet behind, which can be fastened securely to the table, *w x m y*, by means of thumb screws. The two parallelograms, *a b c d* and *c d c f*, are connected by pins, as shown in the figure, so that all the joints can work freely; the lower end of the bar, *e f*, has a stout wire, *j*, inserted into it for a tracer. A sheet of paper, *i' h'*, is tacked to the board, *i h*, at the four corners, and a tracing pencil is inserted in the socket, *g*. The face of the board is now set on the line *q r*, the face of the square, *v r*, is set on the line *i*, the face, *v u*, lying on the table parallel to *m l*. The tracer, *j*, is then brought up to the top of the mould-board and is carried along to the bottom, touching the surface at every point in its passage, being directed by the face, *v r*, the line of motion being recorded accurately by the pencil, *g*, on the paper, *i' h'*. The face of the board is now set on the line *o p*, and the face of the square, *v r*, is placed on the line 2, and the line 2 is traced on the paper as before. In this way the board is successively set backward on all the lines ruled on the table, taking care that its lower right-hand corner is kept on the line *m l* until all the lines of the mould-board are transferred to the paper. A little attention to the action of the jointed parallelograms, *a b c d* and *c d e f*, will show that the path of the pencil, *g*, must be exactly parallel to that of the tracer, *j*. If the point of the tracer passes down a vertical line, the pencil will trace a vertical line on the paper. If it passes along a horizontal line, or an angle of 45 deg., or over a convex or concave line, precisely similar lines will be traced on the paper, and it is by this method that the lines of the figures on Plate IV have been traced. It may be, perhaps, proper to say that the bars, *a b*, *c d* and *e f*, are each three feet long, one and one-half inches wide, and three-quarters of an inch thick. The four bars, *a c*, *b d*, *c e* and *d f*, are of similar breadth and thickness, and are all made of hard wood, and are jointed together on brass studs, care being taken that the perforations are all made exactly equidistant from each other.

Fig. 111 of Plate III is a geometrical elevation of Small's or the East Lothian plow in a plane parallel to the land side of the mould-board, *l d* being its base line. The perpendicular lines of division, commencing from the line *o o*, or zero, and extending right and left, are the lines of section. Those to the right or fore end of the mould-board, marked *a a*, *b b*, etc. The curved line, *x y z*, represents the oath described on the face of the mould-board

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by the lower land side edge of the furrow slice, as the mould-board passes under it, which is called the line of transit.

Fig. 112 is a front view in elevation of the same plow, and corresponding to Fig. 111, Plate III; *k m* is the base line, *m g* is the land side plane in a vertical position, *m* also is the place of the point of the share, and *h i* the line of junction between the neck of the share and the mould-board; the remaining lines beyond *h i* exhibit the outline of all the sections taken by the instrument in reference to the lines in Fig. 111. Thus *o o g m* is the section of the entire body of the plow in the plane of the zero, *o y o* being the outline of the mould-board at this section, and *y* the zero point; *a a g m*, the first section forward of the zero, *b b g m*, the second, and so on. In like manner, 1 1 *g m* is the first section backward from the zero, 2 2 *g m* the next section backward, and so on, each section so lettered and numbered having relation to the divisions carrying the corresponding letters and numerals in Fig. 111. The entire series of lines 1 1 2 2, etc., and *a a b b*, etc., thus form a series of profiles of the mould-board, supposing it to be cut vertically by planes at right angles to the land side of the plow. In Fig. 112, also, the dotted line, *m y z*, represents the line of transit, as in Fig. 111, and *z k* represents a transverse section of the slice as finally deposited by the mould-board.

Mr. Stephens, it will be observed, gives none of the horizontal lines, confining himself wholly to the vertical lines; in fact, very little attention is paid to these lines in any part of Europe, being left to arrange themselves by chance out of the arrangement of the vertical lines, which alone receive attention. In this respect it will be seen hereafter they differ very materially from the best class of American plows, in which much attention is very properly given to the arrangement of the transverse lines.

The reason for this difference is found in the fact that the plowmen of Great Britain have an almost superstitious reverence for the high shouldered, crested furrow. The proprietor and the plowman both delight to stand on the headland when the work is done and survey the even furrows, laid so straight that the pencil rather than the plow would seem to have traced them. The furrows must be of precisely even thickness, in all their length. No departure from a mathematical straight line is tolerated. You must see a mouse running in the bottom of every furrow from end to end. But the crowning glory in their eyes was to see the crowning angle of the furrow slice unbroken and unabraded from

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end to end. The plow which insures this result most certainly is the best plow in their eyes, even though it should require more power to draw it, though it should wear out faster, and though it were far more costly than another.

The English plowmen would not subscribe to our chapter on "The Objects to be Accomplished by Plowing." The plow is not the implement to pulverize, in their view, but the harrow. Pulverizing properties would be objectionable to them, as it would interfere with a sharply defined crest. Since the vertical lines of the plow are those which determine the shape of the crest, it is not wonderful that their formation should have monopolized the ingenuity of the English plow wrights.

Turning our attention to the sections of the various plows given in Plates III and IV, we shall see plainly enough that all the plows there given have been constructed with reference to this object. On inspecting Fig. 112 we see that the lines of the plow in front, *c c*, *b b* and *a a*, are concave *above* the line of transit, while those in the rear , 1 1 and 2 2, are concave *below* that line. The lines in contact with the slice are all of them straight, or nearly so, agreeing in this respect with the plan of Mr. Jefferson. It differs from his in this, that as the generating line of this plow as Small finally made it, is a catenary curve, Mr. Jefferson's generating line is a straight line. This will be understood by a recurrence to Fig. 18, which represents Mr. Jefferson's method of forming the twist of his mould-board.

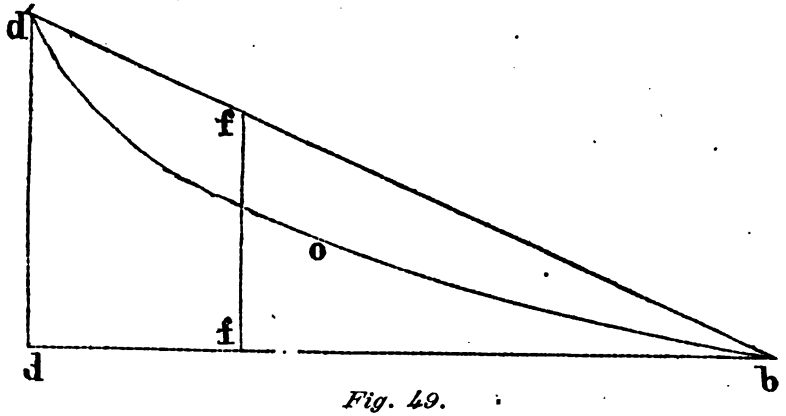

Fig. 49.

If we now take in elevation, Fig. 49, what is shown in plan in Fig. 18, by erecting a post, *d d'*, twelve inches high at the point *d*, and stretching a cord tightly from *d'* to *b*, we shall have Mr.

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Jefferson's generating line; one end of a twelve-inch rule carried along from *b* to *d'*, Fig. 49, and the other end along *e c*, Fig. 18, will describe the twist of his mould-board in the air. The twist of Small's mould-board is obtained by extending the cord *d' b*, and suffering the slack to fall by its own gravity, when it will assume the curve *d' o b*. One end of the ruler being carried from *b* through *o*, along to *d'*, Fig. 49, and the other along the line *e c*, Fig. 18, will describe in the air the twist of Small's mould-board. By the substitution of a curved line for a straight one, Small obtains a wider wing without making the fore part of the plow too blunt, and thus insures the result so highly coveted by the British plowman, of giving a high sharp crest to the furrow. It is difficult to imagine any practical purpose which is obtained in giving concavity to the parts above the transit line in the fore part, and below it in the hind part of Small's plow. The zero line *o o*, it will be seen, makes a very small angle with the line which at first was the bottom of the furrow slice, but which has now assumed a vertical position, and hence there is a correspondingly small tendency to break off or abrade the corner *y*, which, when finally deposited, forms the crest. The angle thus formed with the lower face of the furrow slice is much smaller than in the Rotherham plow, which had a tendency to break off the crest, and it is to this circumstance more than its superior lightness and its improved mechanical construction that the great popularity of Small's plow was owing.

The next improvement in the plow was made by Mr. Wilkie, of Uddingstone, near Glasgow. We have used the word "improvement;" we had better have used the word alteration, for until this day it is not fairly settled that it is really better than Small's. It is now generally known as the *Lanarkshire Plow*. The body frame, which in Small's plow, Fig. 28, is made of cast iron, is made of malleable iron in the Lanarkshire; the two arms, *b* and *c*, instead of being bolted to the frame are welded to it, and form prolongations from the beam and left handle. The bridle, coulter and some other parts show trifling variations of form, but nothing differs in principle from Small's, except that it is provided with two very useful appendages, which should be attached to all plows, as they save much time, and their presence will induce the plowman to temper his irons and keep the plow in much better condition for work than he would do in their absence.

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They are the plow-staff and hammer nut-key, represented in Fig. 50 and Fig. 51.

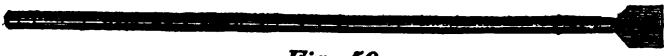

Fig. 50.

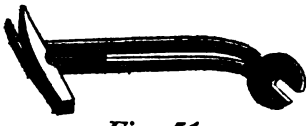

Fig. 51.

Comparing the sections of this plow, Plate III, figs. 117 and 118, it will be seen that the lines are sharply convex, which will increase its pulverizing power, as will be shown hereafter, and it will also be seen that the zero line *o o* coincides for half its length with the face of the furrow slice in its vertical position, and therefore has less tendency to rub the angle at *y*, than Small's plow. It is two inches narrower from the beam to the rear upper angle of the mould-board; the left handle stands nine inches farther to the left. The edge of the feather rises from the point to the rear angle of the feather. The *Mid Lothian Plow* partakes of the characteristics of the Lanarkshire and East Lothian plows. The curves of its mould-board, as seen in Plate III, figs. 113 and 114, show a tendency to convexity in the extreme lower part, while the greater portion of the upper part are straight, like Small's. The zero line makes a smaller angle with the vertical furrow slice, and has therefore less tendency to disturb it. Its share rises from the point to the rear corner of the feather, like that of the Lanarkshire, and it will of course leave the bottom of the furrow as represented in Fig. 98.

Mr. Stephens has invented a mathematical method of forming a mould-board, which, though substantially on the plan of Mr. Jefferson's, has some modifications which are decided improvements. Instead of using a straight diagonal, like Mr. Jefferson, he uses the arc of a circle, and, by lateral additions to his block, he is enabled to make such an overhang to the wing of the mould-board as to make it fall into its place with certainty, and, at the same time, to give an easy and gradual entrance to the breast of the plow. We give his method in his own words:

"From a careful study of the foregoing diagrams (Plates III and IV), and from a comparison of numerous implements and their practical effects, together with a consideration of the dynamical principles on which the plow operates, I have been led to adopt a theoretical form of mould-board, which seems to fulfill all the conditions required in the investigation, and which is capable, by very simple modifications, of adaptation to the circum-

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stances of the medium on which it works. In the outset it is assumed that the soil is homogeneous, and that it possesses such a degree of tenacity and elasticity as to yield to the passing form of the plow, and to resume, when laid in the due position, that form which was first impressed upon the slice by the action of the share and coulter; the second consideration being the cutting of a slice from the solid land. In a theoretical view, this must be an operation through its whole depth and breadth; hence the share is conceived to be a cutting edge, which shall have a horizontal breadth equal to the breadth of the slice that is to be raised, and that the face or land side of the coulter shall stand at right angles to this. Another consideration is, that the slice now supposed to be cut has to be raised on one side and turned over through an angle of 135 deg., the turning over being performed on the lower right hand edge, as on a hinge, through the first 90 deg., the remaining 45 deg. being performed on what was at first the upper right hand edge (*m*, Fig. 97). The slice, in going through this evolution, has to undergo a twisting action and be again returned to its original form of a right prism. To accomplish this last process, it is evident that a *wedge*, *twisted* on its upper surface, must be the agent; and to find the form and dimensions of this wedge is solving the problem that gives the surface of the mould-board required.

We have seen, Fig. 97, that the slice, in passing through the first ninety degrees, describes the quadrant *d k* with its lower edge, and in doing so we can conceive a continued slice to form the solid of revolution *a b c d e*, Fig. 123, Plate IV, which is a quarter of a cylinder, as shown here in isometrical perspective; the radius *a b* or *a c*, being equal to the breadth of the slice. We have next to consider the angle of elevation of the twisted wedge; and in doing so we must not only consider the least resistance, but also the most convenient length of the wedge. In taking a low angle, which would present, of course, proportionally little resistance, it would at the same time yield a length of mould board that would be highly inconvenient, seeing that the generating point, in any section of the slice, must ultimately reach the same height, whether by a high or a low angle. From experience, we find that from the point of the share to that point in the plow's body where the slice arrives at the perpendicular position, which I have named the zero, that thirty inches form a convenient length. The length *c d* of the solid is therefore made equal to

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Plate IV.

ANALYTICAL SECTIONS OF MOULD-BOARDS.

Fig. 119. *The Western Fifeshire.* Fig. 120.

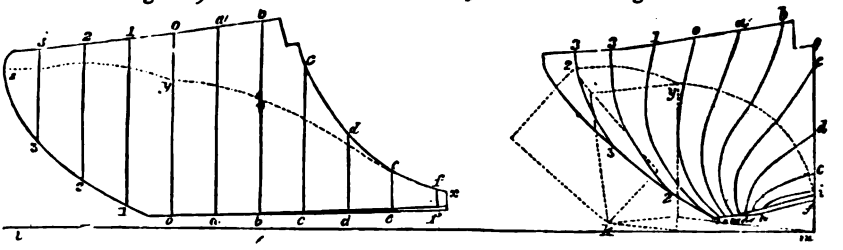
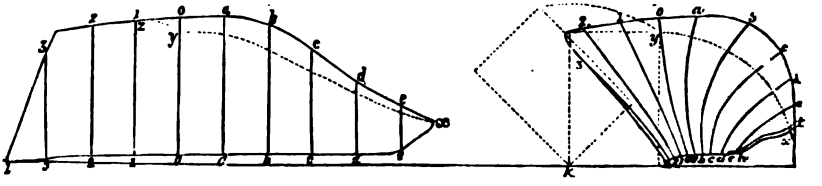


Fig. 121. *Ransome's F F.* Fig. 122.



The New Mould-Board.
(Figs. 123–128.)

Fig. 127. Fig. 128.

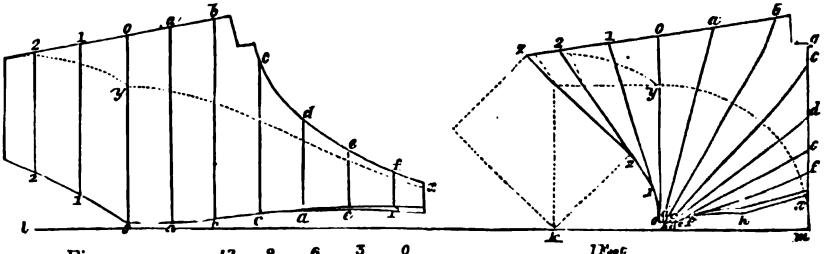


Fig. 124.

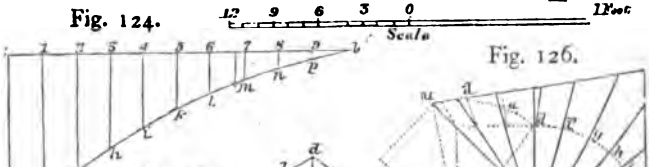


Fig. 126.

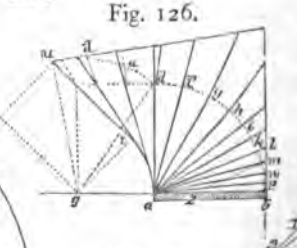


Fig. 123.

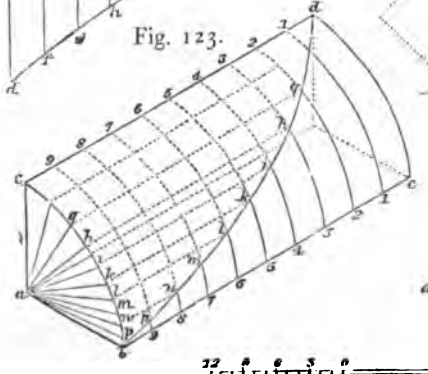
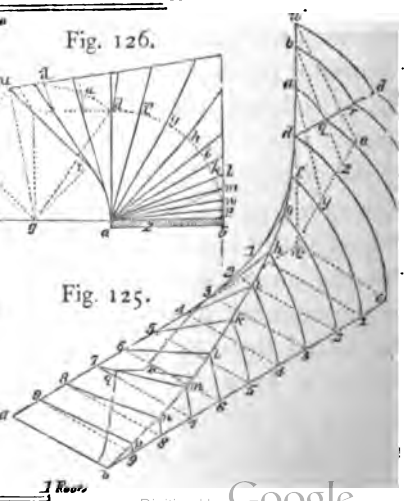
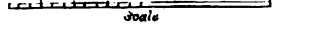


Fig. 125.





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thirty inches or more, and this being divided into ten equal parts, the parallels 11, 22, 33, &c., are to be drawn upon the cylindrical surface, and between the points *b d* a curve has to be described that shall be the line of transit of the slice. After investigating the application of various curves to this purpose, I have found that the circular arc is the only one that can be adopted. It presents the least attainable resistance in the first stages of the ascent, where the force required to raise the slice is greatest, and in the last stages where the force of raising has vanished, leaving only what is necessary to turn the slice over, there the resistance is greatest; and, above all, the circle being of equal flexure throughout, it is in every way best adapted to the objects here required. To determine the radius of curvature of this arc, we must evolve the cylindrical surface, *c b d e*, and from it construct the diagram, Fig. 124, Plate IV. Draw *e b* equal to *c d* of Fig. 123; *e d* equal to the length of the arc, *c b* or *d e*, and at right angles to *e b;* divide *e b* into ten equal parts, and from the points of division draw the ordinates 1*f*, 2*g*, 3*h*, etc., parallel to *e d;* from *b* set off ten inches for the length of the share along the line *b e*, which will fall one inch beyond the division 7, and at this distance draw the dotted line parallel to 7*m;* upon this set off two and one-half inches, and through the three points, *d m b*, describe an arc of a circle, whose radius will be found equal to the circumference of the cylinder, of which *a b c*, Fig. 123, is a quadrant. The circular arc thus found is to be transferred to the cylindrical surface *c b d e*. The transfer may be performed by drawing the arc on paper, and the paper then laid over the cylindrical surface in such a manner that the points, *b m d*, shall be brought to coincide with the points, *b m d*, of the cylindrical surface; when the remaining points *f g h i*, or any number more, may be marked on the cylindrical quadrant by pricking through the paper with a pointed instrument at short intervals along the arc; or the lengths of the ordinates, 1*f*, 2*g*, 3*h*, of Fig. 124, may be transferred to the corresponding parallels of Fig. 123, when the lengths of the ordinates will cut the parallels in the points *f g h*, etc. In either case the curve can now be traced through the points *b p n m*, etc., on the cylindrical surface. Through the points *b p n m*, etc., draw the dotted lines, *f f'*, *g g'*, *h h'*, parallel to *c d* or *b e*, and from the centre, *a*, draw the radii *a f'*, *a g'*, *a h'*, etc.; the unequal divisions of the arc, *c b*, will thus show the proportion of angles of ascent of the slice along the transit now found, *b p n*, etc., for

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each division of the length, while the degree of flexure in the curve or line of transit remains uniform by the same, from any one point to any other equidistant points.

To convert the prism thus prepared and lined off into that of the twisted wedge, we have only to cut away that portion of it contained within the boundaries *a b c d x*, preserving the terminal edges *a b*, *a x* and *d x*, and the prism will thus be resolved into a form represented by a portion, *a b d x e*, of Fig. 125, also in isometrical perspective. Of this figure, *a b d x* is the true theoretical surface of the mould-board, from the edge, *a b*, of the share to the zero line, *d x; a b e x* is the sole; the curve, *b p n m l*, etc., is the line of transit of the slice, and the triangles, 1′*f* 1, 2′*g* 2, 3′*h* 3, 4′*i* 4, etc., are vertical planes, supposed to cut the solid thus reduced in the divisions 1, 2, 3, 4, etc., to the height of the line of transit, as in the analytical sections of the mould-boards.

The surface, now completed, can only raise the slice to the perpendicular position; and, to complete the operation, we have to carry the twisted wedge back till it shall place the slice at the angle of 45 deg. To do this we have to extend the original prism, or suppose it to have been at first sufficiently elongated toward *d d′*, Fig. 125, Plate IV., and to superimpose upon its flat side the portion *d d′ u x*, or *a d u* of Fig. 126. The part *d d′ u x* is now to be worked off into a part of a new cylindrical surface, whose radius is *y d* or *y u*, Fig. 126, and upon this surface the line *d u*, Fig. 125, is to be drawn tangent to the curve *b d* at *d*. A continuation of the divisions of three inches is to be made upon the line *d d′*, and the parallels *a′ q′*, *b′ r′* and *u d′* continued on the cylindrical surfaces. Whatever portion of the superimposed piece, *a d′ u*, may be found to fall within the small arc, *a t*, Fig. 126, is to be cut away, forming a small portion of an interior cylinder concentric to the point *y*, which, being done, the remaining portions of the superimposed piece are to be cut away to the dotted lines *d x*, *a y*, *b z*, *u u′* of Fig. 125, or, what is the same thing, to the lines *d a*, *a′ a*, *b′ t* and *u t* of Fig. 126, forming tangents to the curves at *a t*, and which will complete the surface of the twisted wedge through its entire length, and to the height of the line of transit, producing what I conceive to be the *true theoretical surface* of the mould-board.

Fig. 126, Plate IV, exhibits distinctly in the quadrants *o b d*, the inequality of the angles of ascent for the slice, where the radii *a p′*, *a n′*, *a m′*, &c. represent the ascents to the correspond-

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ing divisions of length in the transit of the slice through the curve *b d u*, which represents the periphery of the cylindrical surfaces at the line of transit. The parts of the figure lying above that line, represent those that must be superimposed above the quadrantal portion of the cylinder, to complete the upper regions of the mould-board; these parts acting merely as a preventive against the overfall of the soil into the waste of the plow, are of less importance as to form, than those just described, but are quite necessary in the practice of plowing. The parallelogram *y d* exhibits the relation in which the furrow slice stands to this form of mould-board, when the slice has been raised to the perpendicular, and *y u* in its ultimate position.

Although I hold this to be the true theoretical form, it is not in this state fit to be employed as a practical mould-board; but the steps to render it so are very simple. The broad shovel-mouth, *a b*, Fig. 125, would meet with obstructions too numerous to admit for a moment of its adoption in practice; but we have only to remove the right hand portion of the edge, *a b*, in the direction *b q*, making the breadth, *q m*, six and one-half or seven inches broad; that portion also contained in 7′ *r* 3 is to be cut away, leaving *m r* about four inches broad; *b q r m* will then represent the share; the mould-board being thus of the prolonged form in the fore part. And, though this form has no peculiar advantage over the truncated, in respect to working, it is better adapted to admit of the body being constructed of malleable iron, a practice which, though more expensive, is certainly the most preferable, by reason of its greater durability, and being less liable to fracture through the effect of shocks when stones or other obstructions are encountered.

Besides the removal of these parts of the theoretical mould-board, other slight modifications are admissible. When the parts have been cut away as described, the edge, *b q*, of the share will be found too thick for a cutting edge. If brought to a proper thickness by removing the parts *below*, making the edge to coincide with the curved surface, the share so prepared would have the character that belongs to the cresting plows. The lower edge of the mould-board, from *r* to 2, would be also rather high, and would present unnecessary resistance to the lower side of the slice; both parts, therefore, require to be reduced. The surface of the feather, *b q*, is to be sloped down till it becomes straight between the points *b* and *q*, *q* not being more than one-quarter of

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of an inch above the plane of the sole, as at the dotted lines, *m z*, in Fig. 126. The lower edge of the mould-board is also to be rounded off as shown by the dotted lines along the lower edge from *h* to *o*, Fig. 128. To prevent the abrasion of the edge of the slice in passing over the mould-board, it will also be expedient to make the lines from *d* to *u*. in Fig. 126, fall in from below the line of transit upward, as shown in the dotted lines at *d' a' b' u.*"

In order to complete this subject for the benefit of plow-makers, we give Mr. Stephens' method of forming the pattern of a mould-board, practically, as we have already given them theoretically.

The Mould-board Pattern.—In this operation the quadrant of a cylinder, upon which the principle is founded, may or may not be prepared. If it is to be employed, then the first process is exactly as before described in reference to the quadrant, Fig. 123, Plate IV, which must be formed and lined as there described; but the same process may be pursued by lines alone, without the intervention of a solid, and in the following manner: Having described the quadrant of a circle, as *a b c*, Fig. 123, of ten inches radius, construct the diagram, Fig. 124, as before directed, the entire length, *e b*, being thirty inches, divided into equal parts of three inches each. The arc, *b d*, is then to be drawn through the points *b*, *p*, *n*, *m*, which points, instead of being a transfer, as before described, from the quadrant, may be drawn directly by a beam compass touching the three leading points, *b m d*, as before, which will intersect all the divisions, converting them into ordinates, 1*f*, 2*g*, 3*h*, etc., to the curve, *b d*. The lengths of these ordinates from the base line, *e b*, are now to be carefully transferred to the quadrant of the circle, *b d*, of Fig. 126, and set off in the circumference thereof; thus, the point *b*, in Fig. 126, corresponds to the termination, *b*, of the base line in Fig. 124. The first ordinate, *q p*, is to be set off on the quadrant from *b* to *p*; the second ordinate, 8*n*, is set off from *b* to *n*; the third, 7*m*, from *b* to *m*, and so on through the entire quadrant of the circle. The radii, *a b*, *a p*, *a n*, etc., being now drawn, will furnish the successive angles of elevation, with the sole plane for each division of the length throughout the quadrant.

In applying these to the mould-board, it is to be observed that the first three radii belong to the share, if it is a prolonged mould-board; or the first five, if it be truncated. The quadrant, Fig. 126, with its radii being thus completely drawn out at full size upon a board, produce the line *b a* to *y*, and on *y*, as a centre

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with a radius of seven inches, describe the arc *a t*, and concentric to it the arc *d u*. At an angle of 45 degrees, draw *t u* a tangent to the arc *a t*, and the point of intersection of this tangent with the arc will fix the extreme point, *u*, of the mould-board at the height of the line of transit, which point will be nineteen inches from the land side plane, *b g*, and twelve inches above the plane of the sole or base line, *y b*. From *d* lay off divisions of equal parts on the arc, *d u*, each equal to four and a half inches—the diagonal of a square of three inches—which completes the lines for the fabrication of the pattern.

The next step in the operation is that of *building a block*, out of which the pattern is to be shaped. Provide a deal-board of three and a half feet, or thereabouts, in length, with a breadth of ten inches; have it dressed of a uniform thickness, and at least one end and edge straight and right angled, as seen at *a b c* in Fig. 52, and *a b*, fig. 126, Plate IV, forming a basement to the block, *a* being the right angle, and the continuation of the board being hid from view under the superimposed block. Let the edge, *a c*, of the board be marked off in equal divisions of three inches, agreeing exactly with those of the diagram, Fig. 124, marking the divisions with letters or numerals corresponding to the radii of the quadrant, Fig. 126, the end, *a b*, of the board corresponding to the radius, *m*, of the quadrant, and to the ordinate, 7*m*, of the diagram. Provide, also, a suit-stock or bevel of the form represented by *d e f*, the stock, *d e*, being a straight bar with a head-piece at *e* fixed at right angles to the stock, and into this blade, *a f*, is to be jointed in such a manner that when the blade and stock are set parallel to each other they shall just receive the thickness of the basement board between them, the length of the blade being equal to the breadth of the slice. Five or more pieces of well seasoned, clean, three-inch Memel or yellow pine deal are now to be prepared, each about thirty inches in length and from six to four inches in breadth. Set the level to the angle, *b a m*, Fig. 126, and, applying it at the end of the board, as in Fig. 52, it will point out the position in which the first block must be placed on the board in order that it

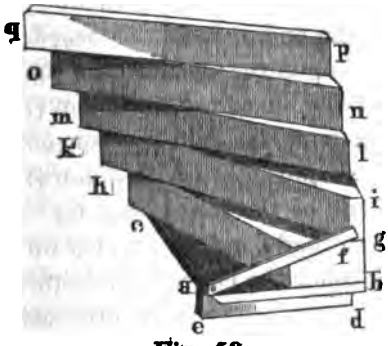

Fig. 52.

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may fill the lines of the pattern. The farther end of the block being set in like manner to face within the lines, it is to be firmly attached to the board by screw nails. The second block, *k i*, is to be joined to the first by the ordinary method of glueing, being set in the same manner as the first, to fill the lines of the pattern at both ends, and this requires its being set obliquely to the first. The third block, *l m*, is set in like manner, and so on with *n o* and *p q*. The setting of the different blocks will be much facilitated by having the ends, *g i l n p*, cut off to the plane of the land side, that is, to coincide vertically with the land side edge of the board, and by keeping in view that the terminal line lies at an angle of 45 degrees.

The block being thus prepared, the process of *working it off* is plain and easily performed in this way: Having set the bevel at the angle, *b a m*, Fig. 126, which answers to the end, *a b*, of the block, the bevel is applied as in the figure, and the surplus wood is cut away to a short distance within the end, *a b*, of the board, until the blade of the bevel lies evenly upon the surface, and the kneed head-piece touching the edge of the board. Set the bevel now at the angle, *b a l*, and, applying it at the first division on the edge of the board, cut away the surplus wood with a gouge or other tool, in a line parallel to the end of the board or at right angles to its edge, until the edge of the blade, *a f*, lies evenly on the surface, and the head of the stock touch the edge of the board as before. Repeating this operation at each successive division with the bevel, setting it to the corresponding angle up to the zero or vertical line, and we have a series of leading lines or draughts, each occupying its true position on the surface of the mould-board to the height of the line of transit. By continuing these lines, each in the direction already given it, until they terminate in the breast or in the upper edge of the pattern, we have a corresponding series of points now determined in the breast and upper edge; and by removing the surplus wood still remaining in the spaces between the lines, and reducing the surface to coincide with them, we have the finished surface from the neck of the share up to zero.

To complete the after portion of the pattern, we have to form a temporary bevel with a curved blade adapted to the small arc, *a t*, fig. 126, Plate IV, which blade is prolonged in a tangent, *t u*, at the angle of 45 degrees. With the guidance of this bevel, its stock being still applied to the board as in Fig. 129, cut away all

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the wood that occurs to interrupt it behind the zero, until it applies everywhere behind that line without obstruction. At the third division beyond the zero the pattern may be cut off in a right vertical, though this is not imperative, as the mould-board may be made considerably longer or a little shorter, without at all affecting its operation. At whatever distance in length its terminal edge may be fixed, that portion of the line of transit which lies between the zero and the terminus must leave the original curve, *h m d*, Fig. 123, at a tangent, and it will reach the terminus as such, or it will gradually fall into a re-entry curve, according as the terminus is fixed, nearer to or farther from the zero line, the terminus of the line of transit being always nineteen inches distant from the land side plane. That portion of the surface which now remains unfinished between the arcs, *a t* and *d n*, Fig. 126, is to be worked off in tangents, applied vertically to the arc, *a t*, and terminating in that part of the line of transit that lies between *d* and *u*. Such portions of the interior cylindrical surface as may have been formed under the application of the temporary bevel to the arc, *a t*, are now also to be cut away by a line passing through the junction of the tangents, *t a'*, *t b'*, *t n*, with the cylindrical arc, *a t*, forming a curved termination in the lower part, behind, as seen in Fig. 127, which completes the surface as proposed. The breast curve and the form of the upper edge will now have assumed their proper curvature, and there only remains to have the whole pattern reduced to its due thicknesses. This, in the fore part, is usually about one-half inch, increasing backward below to about one inch, and the whole becoming gradually thinner toward the top edge, where it may be three-sixteenths of an inch.

We may now sum up the modern history of the plow in Scotland by saying that all the plows now in use there are formed on one of the three models which we have described, viz.: Small's, Lanarkshire and Stephens'. The Berwickshire has the lines of the mould-board concave, and the western Fifeshire very sharply convex, but the differences are too unimportant to make a minute description necessary.

We now proceed to relate the more modern history of the plow in England. We have already stated that the Rotherham plow was the basis of improvement in England, as well as in Scotland, although its progress in the latter kingdom was exceedingly slow, for reasons which we have previously given.

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The wooden plows formerly used were very liable to get out of order by warping, cracking, etc., and continually needed repairs, which were very expensive, and the going backward and forward to the plow-wright, who often was several miles distant, was a very serious tax upon the time of the farmer, particularly in a climate as variable as that of Great Britain, often causing him to lose the proper time for seeding. To remedy this difficulty in some degree, plows were made of wrought iron, as we have seen in Brand's plow, Fig. 17; but this material being soft and liable to bend, as well as to wear away rapidly, it became very desirable to find a substitute which should be more rigid and less liable to abrasion. We accordingly learn from Mr. J. Allen Ransom's valuable work upon farm implements, that his grandfather, Mr. Robert Ransom, of Ipswich, who seems to have been almost as successful in making improvements in agricultural implements as Sir Richard Arkwright was in cotton machinery, obtained a patent for making plow shares of cast iron in the year 1785. Mr. J. A. Ransom very justly remarks that this circumstance is well worthy of notice, not only as a very important and successful improvement in the part in question, but as the means of drawing the attention of that individual and many others to further improvements in the plow, which were soon after carried into effect.

Another long step in the improvement of the plow was taken by the same gentleman in the year 1803, when he obtained a patent for case-hardening or chilling shares. When plain cast iron shares were used a little while, it was found that the sharp edge of the feather wore away so that it, as well as the point, became thick and blunt. This, as can be easily seen, greatly impaired its efficiency; it lost its hold upon the ground; the weeds were passed over uncut, and a great increase of power was required to operate it. Mr. Ransom chilled the under side from one-sixteenth to one-eighth in thickness. This part wears much more slowly than the upper part. The upper surface grinds away while the lower part is unaffected, and heuce the edge is always sharp. The land side of the point was likewise chilled in the same manner, and with the like results. When the share was finally worn out, the farmer himself could replace it at a trifling expense, without the necessity of resorting to a blacksmith or any other mechanic, and the shape of the iron is always uniform, which it could not be when the point and feather were tempered by the blacksmith, guided by his eye alone.

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Figs. 53 (*a* and *b*) show shares which have been broken, and the white lines at the edge show the chilled parts.

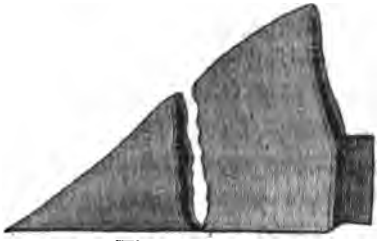

Fig. 53.—(a)

This new process proved of such practical utility that it was soon extended to other parts. A Suffolk farmer invented for his own use a cast iron sole-shoe, which was also chilled at the bottom. It was provided with mortises to receive the tenons of the wooden parts, and soon got into general use. It is represented at Fig. 54. The old difficulty, however, still remained, notwithstanding these great improvements. So long as any portion of the plow was made by the blacksmith, changes would be made in the curves and other parts upon which its useful action depended,

Fig. 53.—(b)

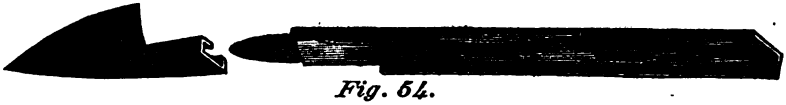

Fig. 54.

and there was a consequent uncertainty on the part of purchasers whether the plows would perform good work. As improvements

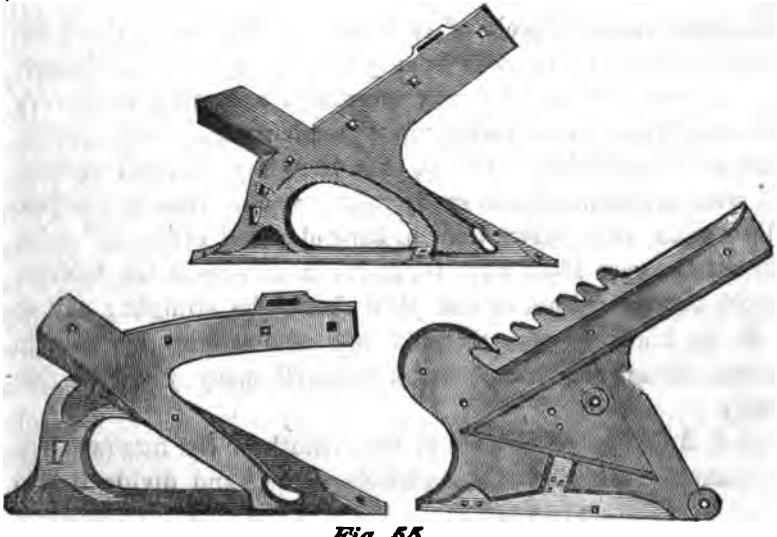

Fig. 55.

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were made in moulding and casting, it became possible to make the whole plow of cast iron, so that when a farmer once had a plow that exactly suited him, it could be accurately and certainly reproduced, and multiplied to any extent, at a very small cost. The next step, after the adoption of the sole shoe, was to make the entire frame of iron. They were so constructed that all parts—the handles, beams and shares, the sole, the mould-board and the braces—could be screwed upon with a much greater firmness and much greater capability of adjustment than had ever been attained before. Sketches of three of these frames are given in Fig. 55.

The following figure (56) will show how the mould-board and share was attached to the frame.

Fig. 56.

The plow made entirely of cast iron was introduced about the year 1800, and by 1810 was in very common use. The changes made in the plow for the next quarter of a century were very slight, and these were mainly in the adaptation of the mould-board to different kinds of soil, that is to say, concave vertical lines were adopted in loose sandy soils; straight lines in medium mellow soils, and convex lines in hard clay and other stiff soils.

About the year 1840, Rev. W. L. Rham developed the doctrine that the *transverse* lines of the plow should be straight; and so far as we know, he was the first one who taught this rule in Europe, though he had been anticipated many years in this country.

Let A B C, Fig. 57, represent the breadth of the furrow. On this diameter describe the semicircle, A 4 C, and divide it into

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Plate V.

PLOWS

Howard's Plow.

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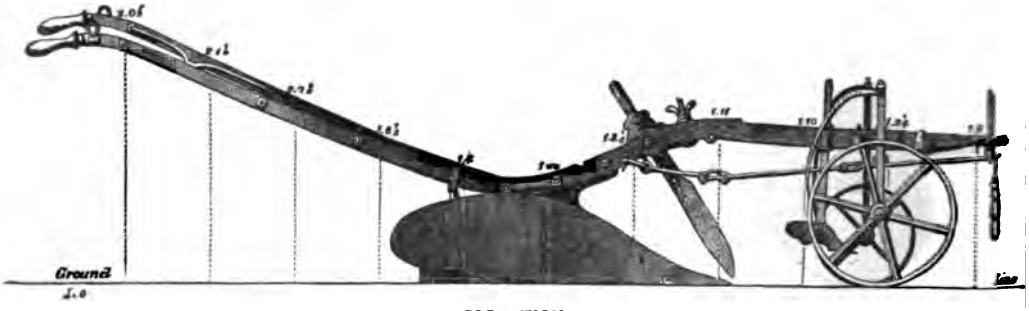
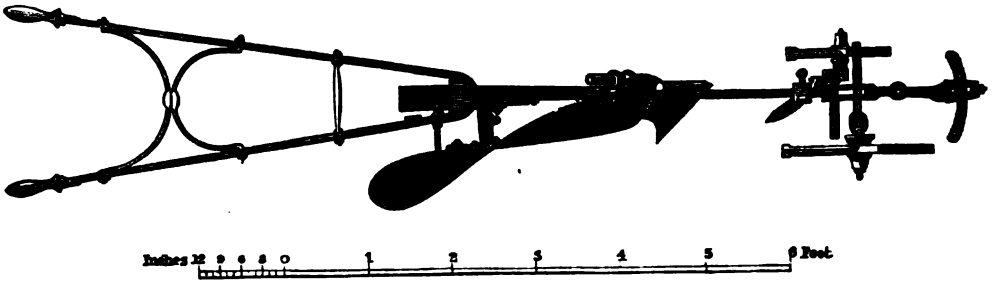


ELEVATION.



Ransome's Plow.

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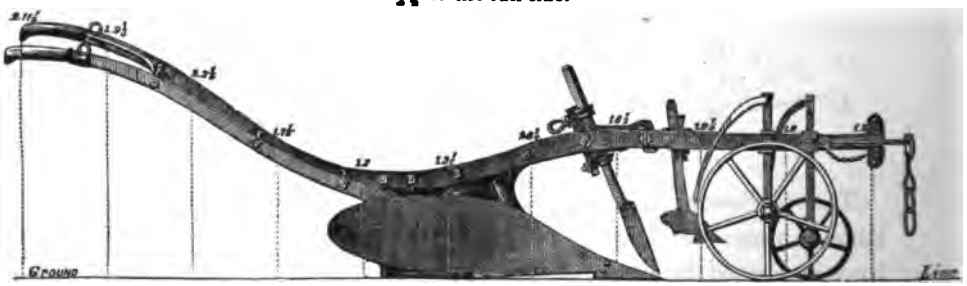

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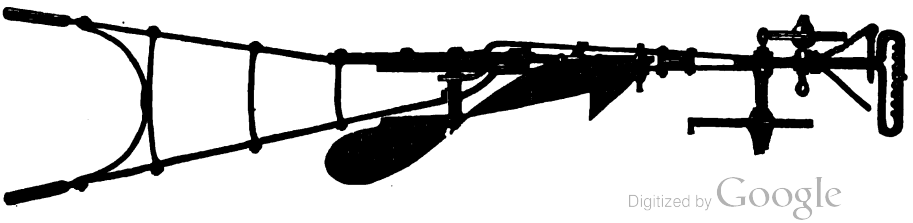

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equal parts, 1, 2, 3, 4, etc., and draw the radii, B 1, B 2, B 3, etc., draw the parallel lines, 1 1′, 2 2′, 3 3′, etc. Draw the share, *d f g e*, and the lines *d e*, the neck of the share, and 3′ 6′, making the distance between them equal to the length of the mould-board. Draw the diagonals 6′ *d*, 5′ 1′, 4′ 2′ and 3 3′. These lines will represent the twist of the mould-board, the zero being at *h*.

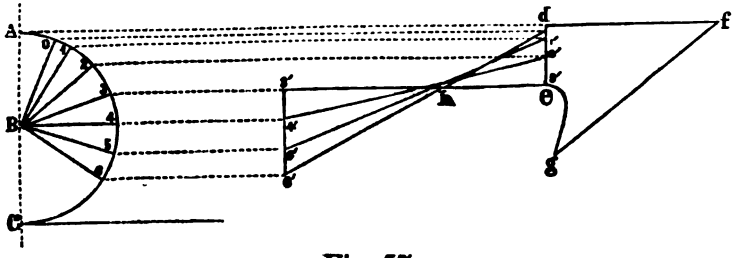

Fig. 57.

Mr. Rham recommends that all plows should be thus made, with straight transverse lines, but that the vertical lines should be altered to suit different soils. So that, for medium mellow soils, the vertical lines should be straight; for stiff clays, convex, and for sandy and loose soils, concave; the *degree* of convexity to be proportioned to the stiffness of the clay, and the degree of concavity to be proportioned to the looseness of the sand.

Fig. 58 represents these various sections. A B represents the section contiguous to the neck of the share; C B in the middle of its length, and D B at the heel. No. 2 represents the convex lines for stiff soils, and No. 3 the concave lines for loose soils.

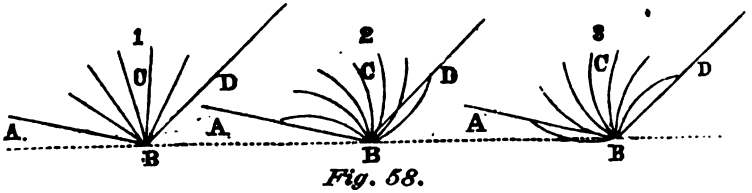

Fig. 58.

The tendency of plow-makers since the publication of Mr. Rham's views has been to approximate their mould-boards to the lines indicated by him.

We give on Plate V figures accurately representing the plows of Mr. Howard and Mr. Ransom, which may be taken as representing the utmost perfection to which the art of plow-making has reached in England up to the present time.

As the plan of Mr. Rham has been substantially adopted by some of the most eminent plow-makers in England, we will give

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it in fuller detail. It will be observed that Mr. Rham's mould board is curved in the form of the spiral thread of a screw, such as would be generated by a line moved uniformly forward in a direction at right angles to its length, while it revolved uniformly round one of its extremities. This surface is thus generated mechanically—Fig. 59. Take a rectangular parallelogram, A B C D, of the width of nine inches, or as wide as the intended furrow, and of length equal to four times the width. Bisect B C in E, and D C in F; at F raise a perpendicular to the plane of the rectangle at F, and make it equal to C E; join E G, and produce it to K, making K G=E G join K D. Draw from every point in C D lines at right angles to C D, meeting the line E K in different points, these lines will form the required surface. The line K D will be found inclined 45 degrees to the horizon at the angle K D H, which is the inclination at which the furrow slice is most advantageously laid. To those who are not familiar with solid geometry, these lines may be easily exhibited by means of a wire inserted at E and bent at a right angle at K, inserting the bent portion into the board, A B C D, Fig. 60, at D, lying in the direction E K, Figs. 59 and 60. Care must be taken that G F be equal to C E, and H perpendicular to the board. It is evident that, as the plow moves on, a particle at E will slide along the line E K, become at G perpendicular to the plane of the sole, and at K be at an angle of 45 degrees with that

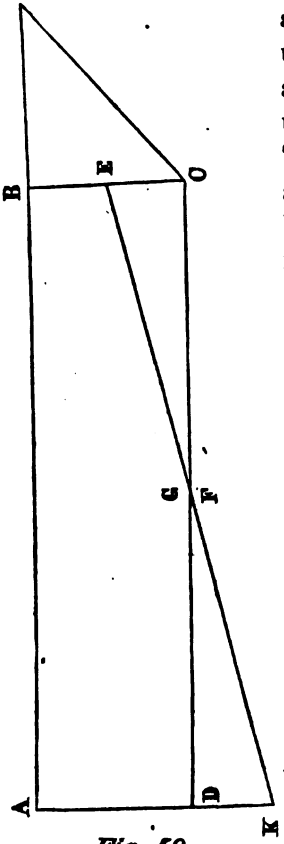

Fig. 59.

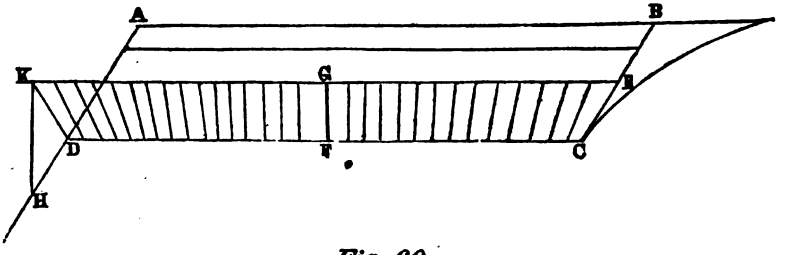

Fig. 60.

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line. If the slice were a solid substance, this line, E K, would be all that is required to turn it in its proper position; but as the soil is generally loose, and would crumble in pieces, a support must be given to it by a surface at least as wide as the slice. This surface is generated by drawing lines from different points of D C at right angles to the line and meeting the line K E.

CHAPTER IV.

AMERICAN PLOWS.

HISTORY OF THE PLOW—CONTINUED.

We now turn to the history of the plow in this country. Until the beginning of the present century the plows used were most deplorable implements, fabricated by the most careless and unintelligent mechanics, scarcely any two being made alike. We cannot find, and we have never seen or heard of, a single plow having been made on the principle laid down by Mr. Jefferson in his day, except those made by himself; in fact the existence of his method was hardly known in this country until within quite a recent period, although it was well known and much talked of in Europe.

Mr. A. B. Allen, in the Transactions of the New York State Agricultural Society for 1856, thus describes the primitive methods of the plow-makers in this country in the early part of the present century:

"A winding tree was cut down, and a mould-board hewed from it, with the grain of the timber running so nearly along its shape as it could well be obtained. On to this mould-board, to prevent its wearing out too rapidly, were nailed the blade of an old hoe, thin straps of iron, or worn-out horse shoes. The land side was of wood, its base and sides shod with thin plates of iron. The share was of iron, with a hardened steel point. The coulter was tolerably well made of iron, steel edged, and locked into the share nearly as it does in the improved lock coulter plow of the present day. The beam was usually a straight stick. The handles, like the mould-board, split from the crooked trunk of a tree, or as often cut from its branches; the crooked roots of the white ash were the most favorite timber for plow handles in the northern

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States. The beam was set at any pitch that fancy might dictate, with the handles fastened on almost at right angles with it, thus leaving the plowman little control over his implement, which did its work in a very slow and most imperfect manner."

It is curious, as well as humiliating, to see how little advance had been made in the fabrication of an implement which lies confessedly at the root of all human civilization. As we have seen, the original plow was a forked stick, with natural crooks which adapted it to the purpose; and after a lapse of three thousand years, the same idea as stated by Mr. Allen was still uppermost in the minds of plow-makers, the last differing mainly from the first in being protected from wear by nailing on old hoes, horse shoes, etc.

It is, however, instructive and interesting to observe that there was, after all, a certain blind instinct in the American farmers' minds which led them somewhat in the right direction. They invariably selected trees for mould-boards which had been accidentally twisted in their early growth, and thus, without knowing or suspecting it, they were approximating to a helicordal curved surface.

The first American who set himself to work to improve the plows in common use, after Mr. Jefferson, was a farmer by the name of Newbold, residing in Burlington, N. J., who made the first cast iron plow ever made in America. He used it successfully himself, but so great was the antipathy to new-fangled notions that no one would imitate his example, and very few would even try his implement.

As this plow was the first that was made of cast iron in this country, and thus inaugurated a new era in the history of the implement, it is from this circumstance invested with so much interest that we give his specification in full, viz.:

"The subscriber, Charles Newbold, of Burlington county and the State of New Jersey, has invented an improvement in the art of plough making, as follows, viz.: The plough to be (excepting the handles and beam) of solid cast iron, consisting of a bar, sheath and mould plate. The sheath serves a double purpose of coulter and sheath, and the mould plate serves for share and mould board, that is, to cut and turn the furrow!

"The forms to be varied, retaining the same general principles, to meet the various uses, as well as inclinations, of those who use them.

"Philadelphia, 17th June, 1797.

"CHARLES NEWBOLD.

"JOHN ALLEN, } Witnesses present at the signing."
"URIAH TRACY, }

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The letters patent were signed by John Adams, President, and Timothy Pickering, Secretary of State, and their legality was certified to by Charles Lee, Attorney General, on the 26th of June, 1797. Fig. 61 is a correct delineation of this plow.

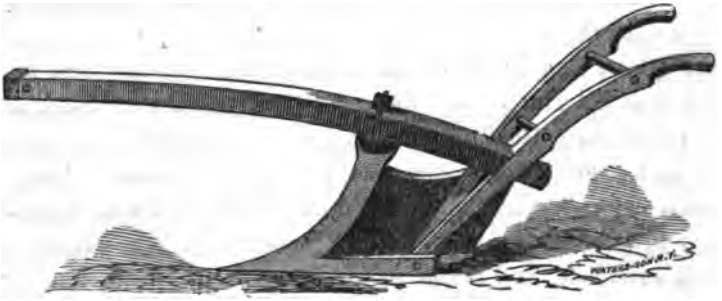

Fig. 61.

Charles Newbold, the inventor of the first cast iron plow ever made in America, was born in the township of Chesterfield, Burlington county, New Jersey, about the year 1780, and in 1804, married Hope, the daughter of David Sands, who lived a few miles south of Newburgh, N. Y. He was endowed with a large share of energy and genius, which developed themselves in the formation of so many schemes and contrivances, which succeeded one another so rapidly in his teeming brain, that he had no time to carry any one of them into successful operation. He had a grand scheme for founding three cities on the Hudson river, to be called Faith, Hope and Charity. These were to be the centres, respectively, of trades, manufactures and commerce. They were to be connected together by the best possible roads, as well as water communication, and from the central city a grand road across the continent, similar to the Cumberland road, was to connect the Hudson river with the Pacific ocean. From this central trunk road numerous lateral roads were to be made to diverge in every direction throughout the entire continent, so that the whole trade and commerce of the country should finally centre in Faith, Hope and Charity. His cotemporaries thought these notions exceedingly visionary, and some of them thought they afforded unmistakable indications of insanity; but a road already exists in an unbroken line, at this day, from Newburgh to the base of the Rocky mountains, and in a few years more, though Faith, Hope and Charity are yet unbuilt, his grand idea of a connection between their sites and the Pacific ocean, by a railroad over the whole route, with lateral communications over the whole United

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States, have been fully realized. He who in that early day, with the eye of faith, could discern this vast system of internal improvement as a present reality, could have been no common man. Some time after his marriage he removed to Cornwall, N. Y., where his wife had formerly resided, and remained there until his death.

His plow, consisting of share, land side, sheath and mould-board, was all cast in one piece by Benjamin Jones, Esq., at the Hanover furnace, Burlington county, some time between the years 1790 and 1796. This plow was put into operation in a young orchard belonging to Gen. John Black; the plowman soon afterwards broke the point, and it was never used afterwards. It is still in existence, and is the property of John Black, Esq. (a son of Gen. Black), of Mount Holly, N. J.*

Mr. Newbold, although he had made a most valuable improvement, was unsuccessful in persuading the farmers of his region to adopt it. He spent upwards of $30,000 in perfecting and introducing his plow, and then abandoned the business in despair, as the farmers had in some way imbibed the strange notion that the cast iron plow poisoned the land, injured its fertility, and promoted the growth of weeds. Towards the latter part of his operations he substituted a *wrought* iron share for the cast iron, but it did not overcome the prejudices which had been engendered, and the farmers still adhered to the miserable bull plows that were in vogue, which took much more power and did not work as well.

There are traces of the use of a cast iron share still earlier than Mr. Newbold's. In the year 1794, it appears by the first volume of the Transactions of the Society for the Promotion of Agriculture, Arts and Manufactures, that "Col. John Smith produced the model of a plow share, according to which it was proposed to have that utensil made of *cast iron*, in order to save expense in husbandry, and come cheaper to farmers than those in common use, forged from *wrought iron;* and Mr. Smith and Judge Hobart were appointed to get several cast for trial." At the next meeting, Col. Smith reported that the cast iron share exceeded his most sanguine expectations. "It is cast in the form of a Dutch share (probably the Rotherham share), after the best model that could be procured by the society, with this exception, that the edge is not complete, and not so wide by about three inches as it will be when finished with the false edge which is made of

* This original plow has been presented by Mr. Black to the State Agricultural Society of New York, for its Museum, in Albany.

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wrought iron or steel and fastened on with rivets." He informs the society that they may be had, either with or without the false edge, of Mr. Peter T. Curtenius, in New York. The Col. Smith above named was afterward Gen. Smith, and was the proprietor of St. George's manor in the county of Suffolk. He was an eminent and extensive farmer, and was one of the original corporators of the old Agricultural Society of New York.

The next plow patented was by John Denver, June 12th, 1804. He was a Marylander, and some old people in that State still remember such a plow, but we can obtain little definite information respecting it; it probably never came into very general use. There is neither specification, drawing or model of it now in the Patent Office.

The next patent was granted to Hezekiah Harris, of Kentucky, February 24th, 1804. We can find no memorial of this plow either in the Patent Office or elsewhere.

A patent was granted to David Peacock, of New Jersey, April 1st, 1807. There is no record of this now in the Patent Office at Washington, all the old records having been destroyed by fire; but we learn on very good authority that it was made of cast iron, and resembled Newbold's plow, except that it was cast in three separate pieces, while Newbold's was cast in a single piece. Newbold sued him for an infringement, but it was finally settled by the payment to Newbold of $1,500. He was very much dissatisfied with his agents, who made this arrangement, and always thought that he had been betrayed by them. David Peacock took out another patent in 1822. There were some improvements made in other parts of the plow, but the chief feature was the famous lock coulter which it is believed he was the first to introduce (Fig. 90). The plows made by Peacock were very extensively used throughout the country, and many of them were to be found in use on farms in this State and in New Jersey and Pennsylvania as late as the year 1850.

The earliest recognition of the importance of straight *transverse* lines in the mould-board that we have met with is contained in the following letter from the celebrated Timothy Pickering, who was a most excellent farmer, as well as an eminent statesman. It was addressed to Dr. Alex. Coventry, and is dated Salem, June 3d, 1820:

"My public employments in the war of our Revolution having caused me to take my family to Philadelphia, I remained there

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after its termination. During four years I lived in the country, and paid some attention to husbandry. One day when learning to hold a plow (a good Pennsylvania plow of that day), the soil, rich and moist enough to be adhesive, I observed that the earth filled the hollow of the mould-board, and assumed a straight line from its fore end, near the point of the share, to its upper projecting hind corner, and that it *maintained* that same straight line. It then struck me that this straight line should exist in every mould-board and direct its curvature. Four or five years afterwards I returned to Philadelphia, having been again called to public life. And, at a subsequent period, visiting Mr. Bordley, the Vice President of the Philadelphia Agricultural Society (of which I was a member, and its secretary at its first formation in 1785), he handed me a small model of a mould-board which Mr. Jefferson had left with him. At the first glance I saw the straight line before mentioned governed its form, and asking Mr. Bordley's daughter, then at her needle, for a piece of thread, I stretched it from the left lower fore part of the mould-board to its right upper overhanging fore corner, and found it in a straight line, touching the mould-board in its whole length. 'Here,' said I to Mr. Bordley, 'is the principle on which this mould-board is formed.'" * * * * "I have given this detail to explain the opinion I now express, *that the straight line therein described is essential to the form of the mould-board of the least resistance.* Around this line the curvature is to be formed; and placing the lower edge or bottom of the mould-board on a level floor, if another straight line be laid transversely on the fore end or point of the mould-board, and moved regularly backward on its face in a plane perpendicular to the horizon, it will touch the mould-board in its whole breadth, throughout its whole length, provided the curvature be correct. In a word, the curvature will be a portion of a spiral screw. Take a large screw auger for an exemplification. No earth can be left on such a mould-board; for every succeeding portion of earth which the plow raises pushes off that which is on the transverse straight line behind it; and the face of the mould-board consists—is made up (mathematically speaking)—of an infinite number of such transverse straight lines.

"One more observation: *The essential straight line* indicates the slope of the wedge on which the furrow slice rises until it reaches that point in the line at which the transverse line is perpendicu-

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lar, after passing which the gradual overhanging of the mould-board pushes the furrow slice (supposing it to rest on its lower edge as a hinge) beyond the centre of gravity, and at length completely subverts it; or, in farmers' language, lays it upon its back. The angle which *the stright line* should form with the sole of the plow is another material point to be discovered by experiments.

"In adjusting this mould-board to the plow, another point is to be determined—the extent of the angle which *the essential stright line* should form with the bar of the share or land side of the plow. The smaller this angle the less the resistance at entering the earth; but if the angle were to be very small, then the plow must have great length to obtain a proper breadth of furrow; and such great length would proportionally increase the quantity of friction. Hence the conclusion, that keeping both these points in view, repeated experiments must decide where lies the just medium of breadth, of angle, and length of mould-board."

The lines running from the front of the plow towards the back are now usually transverse lines, but Mr. Pickering evidently applies this term to the lines running from the sole to the top of the plow.

The next patent granted was to Hezekiah Harris, of Kentucky,

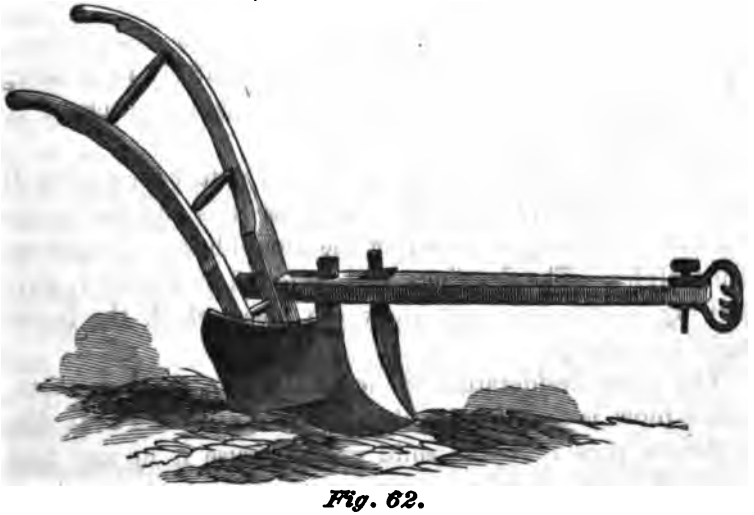

Fig. 62.

on the 24th of February, 1808, of which no record remains in the patent office, and of which we can learn nothing whatever. The next was to Richard B. Chenoweth, of Maryland, a drawing of

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which is given in Fig. 62, and the following extract from the specification will give the idea of the inventor:

"There is attached to the upper side of the mould-board, which is of cast iron, a share which in its shape differs from any other now in practice, it being fastened on the upper side of the mould-board with screws, the point doubling over, but running even with the land side, which is also made of cast iron, and leaving a hollow under the mould-board so that small stones may pass without interruption. The share is made of wrought iron with a steel edge weighing from four to eight pounds."

John Klay, of Maryland, received a patent for a plow dated January 11th, 1812.

Roswell Tousley, of Scipio, New York, received a plow patent on the same day; this man was subsequently a partner of Jethro Woods.

John Seltz, of Pennsylvania, received one February 8th, 1813.

Matthew Patrick, of New York, had a plow patented on the 2d day of January, 1813.

Horace Pease, of Scipio, New York, received a patent for a plow August 28th, 1813.

Jethro Wood, of Scipio, New York, had a patent for a plow granted July 1st, 1814. He did not attach much value to this patent, and never attempted to introduce it extensively, as we are informed by his daughters.

The next patents granted for plows were to John Swan, of Scipio, New York, on the 5th day of July, 1814; to J. Morgan and J. B. Harris, October 11th, 1814; to David Peacock, of New Jersey, May 29th, 1817.

Gideon Davis, of Maryland, received a patent for a plow May 26th, 1818. This plow is interesting, as it is the first attempt since Jefferson's day to construct the mould-board on mathematical principles. The drawings will be found on Plate VI, and the following specification will show the ideas which the inventor sought to embody:

"The great desideratum to be attained in the box share or shallow plow, is that it be so shaped and constructed as to detach the furrow slice from the solid ground, raise it up and turn it over, in the neatest and most uniform and effectual manner, with the least possible labor, both to the plowman and the team, combining at the same time the advantages of being simple in its structure, strong and durable, easy to keep in repair, and cheap.

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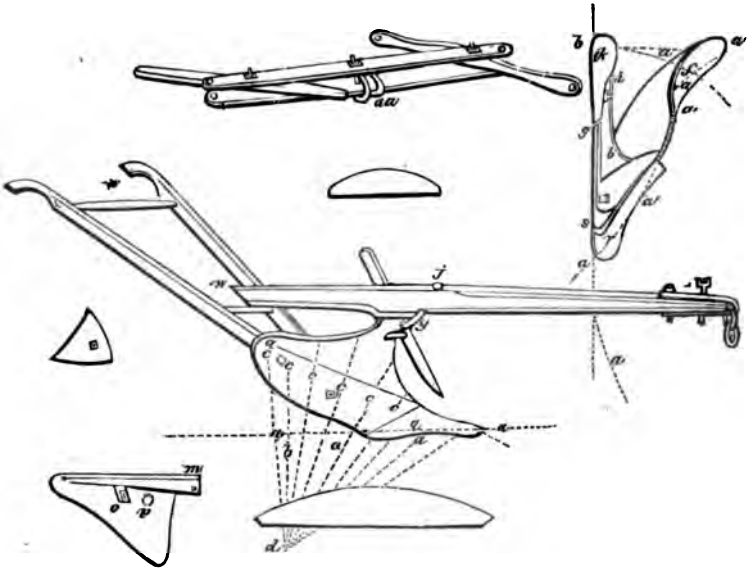
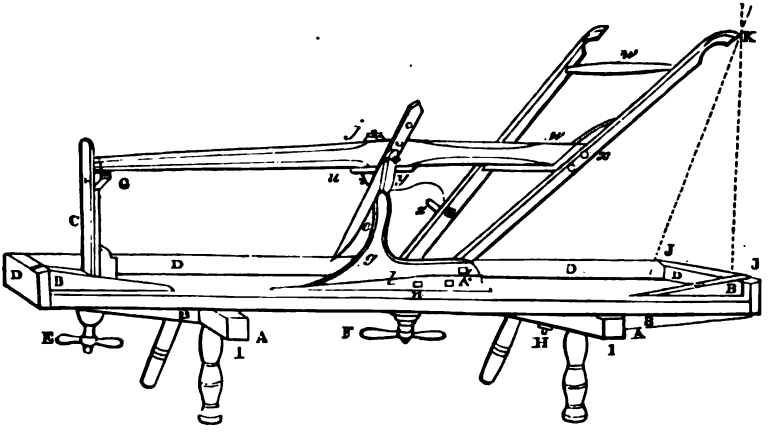
Plate VI.

DAVIS' PLOWS.





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The mode of using, it is desirable, should be such as will cause the least trouble and inconvenience to the plowman.

"With a view to combine as far as practicable these various objects, I begin by making the mould-board, land side, and standard (or width for the beam to rest on), all of cast iron, and in a solid piece; this is done in the manner that Charles Newbold, of New Jersey, made his improved plow, patented in the year 1797, but with several alterations and improvements hereinafter particularly specified.

"*First*—Of the shape of the moulding part, or what is commonly called the face of the mould-board, the general principle heretofore concurred in by all scientific men who have turned their attention to this subject, is that as the furrow slice is detached from the solid ground, at a straight line, parallel to the surface, at such depth as may be required, that it should be raised up and turned over, so as to retain, as far as possible, the same flat shape. In order to accommodate the face of the mould-board to this idea of raising the furrow slice up and turning it over, it has been so constructed as to form straight lines lengthwise, either horizontal or a little inclined, and also to correspond with another set of straight lines at right angles with the land side, or nearly so, commencing at the point touching the edge of the share and lower edge of the mould-board. These last mentioned straight lines, as they recede from the point of the commencement, gradually change from a horizontal to a perpendicular direction, and even pass beyond the perpendicular so far as to give the proper over-jet behind. It has been thought that mould-boards so constructed would fit and embrace every part of the furrow slice in the operation of turning it over, not observing that the furrow slice must necessarily assume a convex form on the under side during the operation by which it is raised up and turned over.

"The truth is, however, that in raising and turning over the furrow slice it always acquires a convex form on the under side, or else it is broken into pieces and thrown over; as might therefore be anticipated, it will be found that all those mould-boards which are constructed on this principle wear through, in the operation of plowing, about midway, whilst the upper and lower edges are scarcely rubbed. It also necessarily results that plows of this description work hard and are of heavy draught, because the mould-board not being adapted to the convex form which the

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furrow slice is disposed to assume, lifts the furrow slice at a single point, and that in the middle instead of being equally applied throughout the entire operation.

"In order to meet and remedy the inconveniences arising from this form of structure, I form my mould-board into a different shape, and instead of working the moulding part or face of the mould-board to straight lines, my improvement is to work it to circular or sphere lines. By repeated experiments I have ascertained that in one direction, viz.: from *a*, Plate VI, fig. 4, inclining to the back part, *d*, the circle or segment of the mould-board, to which the mould-board is wrought, should have about three times the radius of the smaller segments represented by the lines lettered *c c*, &c., the former being thirty-six inches, the latter twelve inches. In order then to shape the moulding part, or the face of the mould-board, having obtained a suitable block, I begin by laying off the bottom (Fig. 3), and (Fig. 4) by circular or spheric lines at *a a a*. If I intend to construct a plow of a proper size to cut and turn a twelve inch furrow, I strike this segment of a circle of thirty-six inches radius (Fig. 1), and at twenty-four inches back from the point *c* at right angles with the land side and twelve inches from the land side; the circle will intersect the angle line; this circle is extended out from the land side; I then work the block to fit the same segment, inclined from *a* (Fig. 4) at the point of the share, to *a* at a perpendicular raised twelve inches from the horizon, with the circle extended in toward the land side; then having wrought to the shape of these two lines, I apply the circular part of the smaller segment (Fig. 2) and work the face of the mould-board, until that segment will have an equal bearing on all parts, corresponding with the cross lines *c c c*, &c., which if produced would all terminate in a point at *d*, which is about thirty-six inches from the perpendicular, where the line *a a* crosses the line *d b;* this being worked off uniformly, forms a section of an oxydromic or spiral curve, and when applied to practice is found to fit or embrace every part of the furrow slice far more than any other shaped plow. The plow may be made larger or smaller, suited to deep or shallow plowing, by enlarging or diminishing the radii of the segments which it is wrought by. Believing that this mode of shaping the moulding part or face of the mould-board is an original invention of my own, not heretofore known or used, and that it is a most important improvement in the shape of the plow, I

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claim the exclusive privilege of making, using and vending the same.

"*Second*—Shape of the throat and hind part of the mould-board: The shape of the throat is exhibited in the accompanying drawing, fig. 4, fig. 5, Plate VI. I construct this part of my plow with a gentle curve from the top of the share entirely up to the beam, which, at a suitable height for a plow designed to turn a furrow slice of about twelve inches in width, say about sixteen inches, will incline forward as it comes up to the beam to form a birth for it to rest on in an easy circular form. I dress it off also round as it ascends from the share, making it broader and broader as it approaches the beam. The object of this peculiar shape is to prevent brambles, long grass, &c., from lapping so short as they would do if the front of the throat were sharp, and the inclination forward at the upper part of the throat forms a curve with the under side of the beam, so as to prevent anything in plowing to be jammed under the beam—the pressure below naturally forces the incumbrance up and forward. when it faces over and the plow cleans itself. This I consider an improvement of great value in plowing in clover, long manure and the like. The head part of the mould-board, Figs. 3 and 4, *f*, I dress off in a gentle curve from the end or wing of the share up to the hind corner of the mould-board. This shape I have ascertained to answer every purpose in turning over the furrow slice, and as it does not come down to the bottom of the furrow the plow works with much less friction, is lighter, cheaper and handsomer.

"Believing these shapes for the throat or breast, and the hind part of the mould-board not to have been known or practiced before my application of it, and that they constitute valuable improvements in the construction of the plow, I claim the exclusive right to use and dispose of them.

"*Third*—The structure of the land side with the mould-board and standard, or the fore and top part of the mould-board: Charles Newbold made his mould-board, land side and standard of one piece, and of cast iron. In connecting his land side to the mould-board, he made it nearly square and stout to give it strength. I make my land side thin and broad, *g*, Fig. 5, which gives more strength vertically, without so much weight. This form also makes it a guard, which prevents sods, dirt, &c., from working in and clogging that part of the plow. In order then

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to give additional strength to the land side sidewise, and to connect it at a proper angle with the mould-board, I make a rib, *h*, Fig. 3, on the land side, about midway between the top and bottom, say about two and a half inches from the bottom. This rib is made broad where it joins the mould-board at *i*, and tapers as it goes back to the birth for the handle to fasten on, where it terminates at *i*, Fig. 3, where I make a projection or jog, which cannot be represented in the drawing, to raise about half an inch for the end of the handle to rest against. This rest, or jog, sustains the pressure of the handle endwise, so that the screw bolt is only required to confine it to the side. C. Newbold made the standard of his plow to pass up through a mortise in the beam; mine extends only up to the beam; the beam is fastened on it with a strong iron screw bolt, which may be made either to pass up through the top of the standard in the front part of it and through the beam vertically, *j*, Fig. 5, or to pass through the beam in an inclined direction, and containing the same inclination through the top of the standard, having on the inside a birth for the nut to work on, J, Fig. 4. There are plows in which the beam is fastened on the top of the standard with two bolts. The improvement which I claim to have invented consists, therefore, only in these particular modes of connection. The advantage of it consists in this—that the fastenings being made by a single bolt upon which the beam can turn, it enables me to adjust the landing of the plow by a simple operation in altering the position of the end of the beam, where it is united to the handle. This will be more particularly described when I speak of the stocking of the plow.

"There have been, also, land sides heretofore constructed which were made thin and broad, but supported in a different manner. My improvement, therefore, consists only in the mode of making the rib, the projection or jog in the inside of the land side, the form of the top of the standard or the fore and top part of the mould-board, which, being made to extend forward under the beam, equalizes the bearing of the beam. Thus a smaller piece of wood will be more sufficient to form a beam than if the fastenings to the handle and standard are brought nearer to each other.

"*Fourth*—The shoe: Charles Newbold made a bar of wrought iron which he caused to extend back from the share to the end of the land side, below it, and fastened to it with a screw bolt passing up through the shoe and land side.

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"Stephens, of New York, applied his shoe on the bottom of the land side of the plow, and fastened with a small screw bolt passing through both. Shoes constructed in this manner will only answer the purpose of protecting the bottom of the land side. The side, however, is equally exposed, and in time will wear entirely off. To obviate this inconvenience, I make a groove or countersink in the side and lower edge of the land side of my plow, which forms a birth for the shoe, and admits of the thickness, without any inconvenience, I make from its projecting out, R R, Figs. 3 and 5; the shoe extends round under the bottom of the land side and fastens on with one or more screw bolts.

"The improvement consists in so constructing and applying the shoe that it protects both the sides and the bottom of the land side. It may be made of wrought or cast iron, or steel.

"*Fifth*—New mode of making, applying and using the share of the plow, whether formed of wrought or cast iron: If I apply the wrought iron share, I make it in the usual way by welding the wing on the land side (see Fig. 6), and fasten it to the cast iron part of the land side with a small screw bolt, *n*, Fig. 5. Then I fasten it to the mould-board by means of a projection made on the front and lower part of the mould-board, with an inclination forward, forming a dovetail or hook which I extend through the share. (See *o*, Fig. 6.) This mode will hold on the share very firmly, but as it is liable, being made of cast iron, to break off, in order to obviate this danger, I fasten the share to the mould-board with a strong screw bolt, having the head made to fit a tapering hole made in the mould-board, and passing down through the wing of the share, *p*, Fig. 6, and drawn up tight with a screw nut. If it be a right-handed plow, this should be a left-handed screw, and if a left-hand plow, then a right-handed screw. This is somewhat the manner in which David Peacock, of New Jersey, fastened the share on his plow, patented in the year 1807, but with this difference: he put two screw bolts and a false coulter through the wing of his share; therefore made it stationary, and without its being made fast to the cast iron part of the land side at all. But, in my mode of fastening the share on, by putting a piece of wood or leather between the wrought and cast iron land sides at *n*, Fig. 5, the point of the share may be somewhat adjusted, and the bar always regulated to suit the shoe of the plow. The point and edge of the share is likewise of a different shape from any that have here-

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tofore been made to my knowledge. Having remarked that the point of the share is always disposed to wear round, I make the point round at first. I also make it about twice as broad as usual, and of course much thinner. The edge of the share is likewise made rather concave or hollow, this being the shape to which it naturally wears. In consequence of this they wear much more uniformly, will last longer and be less expensive.

"It is also a fact that the broad share or coulter point will enter or strike into the ground much better than those of the ordinary construction, and, being much thinner, will retain their edge and work much longer without requiring repair.

"In using the wrought iron share, the point or fore and lower part of the mould-board, especially if the point of the share is suffered to wear off very short, is liable to wear away. To obviate this, I make a plate of wrought iron of suitable thickness, say one-fourth of an inch, Fig. 7, and shape it to fit, or nearly fit, on the front and lower part of the mould-board, and fasten it on with the head of the main screw bolt, with which the share is fastened on, taking care to fit the lower edge down snug to the top of the share. This plate may be put on when needed, and renewed as required.

"If I apply a cast iron share, I make a birth or countersink on the lower and front part of the mould-board (see *q*, Fig. 4, and *r*, Fig. 3), on which I put my cast iron share, in the manner in which Richard B. Chenowith, of Baltimore, fitted the share on his plow, patented in the year 1808, but with the following alterations and improvements: He employed two small screw bolts to fasten his share on; and to enable him to set the edge of the share deeper as it wore off, he made the holes in his mould-board of considerable length, and in such form that the share could, when required, be moved down or with the point and edge forward. Thus the point and edge was extended, but the desired effect was not produced. The point and edge would naturally wear to a bevel on the under side, and it was owing to this circumstance that it would not penetrate into the ground; not because it wanted more length. In my plow the share is fastened on with one screw bolt; more may be used, but are unnecessary. Having the point made round, broad and much thinner than usual, with the edge rather hollow, it is thus accommodated to the shape into which it has a tendency to wear. When it is first put on, a small strip of wood or leather is inserted between the edge of the mould-board and the share.

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(See Fig. 3.) This strip may be about a fourth of an inch thick at or near the point of the mould-board, tapering to an edge at the other end, and about half or three-fourths of an inch wide. This strip should be made of such thickness as to set the point of the share level with the after part of the plow; and as the substance of it is somewhat elastic, the tendency is to diminish the sharpness of the stroke, which would be produced if the castings were to come together. The principal advantage, however, of this method of affixing the share is that it affords an opportunity of adjusting the point and edge of the share, so that when the point and edge of the share have worn to a level on the under side, the piece of wood may be taken out and another inserted of about half the thickness, and then, again, if required, the whole may be taken out. By this operation the point or edge is let down as much as is necessary each time. It, at the same time, inclines the point of the share to the land, which is as necessary as to set it deeper. When worn as long as it can be in this manner, strips of wood may be inserted between the upper edge of the share and the mould-board, which will adjust it still more, as was recommended by Richard B. Chenoweth in the use of his plow.

"In making my cast iron shares and shoes, if I use a metal which is not too high, I have one-half of the mould made of cast iron and the other part of sand, in the usual way. The shares and shoes are thus rendered more uniform and less troublesome to mould, and consequently cheaper.

"In respect, therefore, to the share, whether of wrought or cast iron, I claim the shape of the point and edge as of my invention, together with the modes of fastening the shares on the plow and adjusting them, the modes of moulding and casting shares and other shoes, either wholly in cast iron moulds or partly of cast iron and the residue of sand.

"*Sixth*—The manner of stocking or using the plow, heretofore the object of all constructors, has been, so far as I am acquainted, to make the beam immovably fast to the handle and to the standard, whatever may have been the particular mode of fastening adopted. In stocking my plow the handle is made fast to the land side at *h*, Fig. 5; I then fit the beam on the top of the standard and on the inside or outside of the handle, so as to lay solid on one and fast against the other, *f* and *t*, Figs. 4 and 5. The beam is there fastened on the standard with a strong screw

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bolt, either passing up through the front of the standard and the beam, as at *j*, Fig. 5, or I pass a screw bolt down through both the beam and the top part of the standard, and fasten the neck of the screw on the inside of the mould-board, at *j*, Fig. 4.

"Either of these modes will permit the beam to move on the top of the standard in the manner of a swivel, so as to turn the fore end of the beam to the right or left at pleasure, which I consider an object of importance in the construction of a plow. The hind end of the beam is then fastened to the inside or outside of the handle, *w*, Figs. 4 and 5. The other handle is fastened to the mould-board with two small screw bolts, and the two handles connected by two rounds *u u*, Figs, 4 and 5. Thus framed, if it be wished to set a horse plow to work, after three horses abreast, I fit a block of wood in between the handle and the end of the beam of about two inches thick. (See *x*, Fig. 5.) It then is necessary to put a brace from the screw bolt that fastens the beam to the handle and fasten it to the handle above with a small screw bolt, Fig. 5. Thus constructed, the plowman can raise the end of the beam by putting a bit of leather or wood between the top of the standard and the beam; if, on the contrary, he wishes to lower it, he can do so by diminishing the thickness of the block under the beam, or he may raise or lower the end of the beam where it rests against the handle. He may give the plow more or less land by adding to or diminishing the block between the handle and the end of the beam, or by loosening the upper screw that fastens the handle to the mould-board at *z*, and driving a wedge between the mould-board or the handle more land will be given, and be reversed. Thus the plow may be readily adjusted as convenience may require; and should the wood spring it can be set right without difficulty or delay.

"The improvement, therefore, which I claim to have invented in the stocking of the plow consists in enabling the plowman thus to adjust the stock at his pleasure, the introduction of the blocks between the beam and the standard and between the beam and the handle, the use of the wedge between the mould-board and the handle, and the particular modes of fastening the beam on the top of the standard and the side of the handle for the purpose of adjusting the plow so as to give more or less land or depth.

"*Seventh*—Of the coulter: If the locked coulter be applied, it is put in a rib on the point of the wrought iron share, much in the usual form, and passed through a mortise in the beam in the

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mode usually adopted. But having satisfied myself by experiments that it requires an increase of twenty-two per cent power of draught more to urge the plow along, with such a coulter, than with a sword coulter properly fitted to it, my attention was directed principally to the latter.

"This I apply in a manner different from any heretofore used. Instead of putting it through a mortise in the beam, I apply my coulter to the side of the beam. (See *y*, Figs. 4 and 5.) My mode of doing it is as follows: Holes are made through the coulter-shank, and a strong screw bolt passed through the beam and coulter; a strong strap of iron is fitted on the screw-bolt outside of the coulter, with a hook which is turned back of the coulter and tapped on the front of the throat of the plow. Thus fitted, if the coulter rests solidly against the standard and fair with the beam, when drawn tight to it with the screw, it cuts to great advantage. To operate more beneficially, the edge of the coulter should stand about five inches in front of the throat and about one inch to land.

"*Lastly*—The mode of using the plow: The ordinary mode of using the plow when drawn by horses or mules is to attach the team to the plow by means of double and single-trees, coupled with what is commonly called clips and open rings. A serious objection to this mode is, that the single-trees, being attached in this manner, are at liberty to dangle about, so that they occasionally are caught in the ground and turned over, the chains become entangled in the legs of the animals, thus occasioning frequently much trouble and sometimes serious injury.

"My improvement consists in the application of the stiff double and single-trees (see Fig. 8), which are constructed by making the double-trees in two bars, so that the single-trees work between them. Thus, all the play is admitted which is needed, and the inconvenience pointed out entirely avoided. The mode in which the double-tree is attached to the plow is by means of a clevis which opens in the bow (see *a a*, Fig. 8), which forms two blocks, admitting of being easily attached to or detached from the plow, perfectly safe, and by which the team can be placed farther from or nearer to the plow, quietly and without trouble.

"Date of patent, October 1st, 1825.

"GIDEON DAVIS.

"William Elliott, } Witnesses."
"Alex. McIntire, }

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We believe that Mr. Davis was the first to dispense with the perforation and consequently the weakening of the beam, in order to insert the coulter. His plan of attaching it to the side was imperfect as compared with modern methods, but it was a step in the right direction.

The inventors of plows now multiply so rapidly that we shall cease to enumerate all the patents that were granted, and confine ourselves to those which involve new ideas, or those which have been remarkably popular. Zadock Harris, of Washington county, in the State of New York, received a patent on the 17th day of March, 1819, for an improvement in the plow, a figure of which is given.

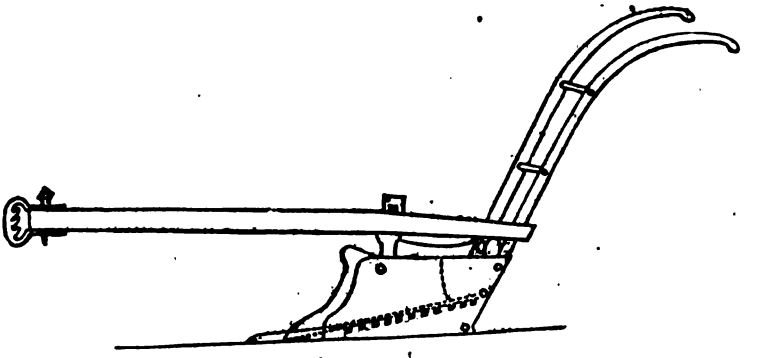

Fig. 63.

The following extracts from the specification will make the drawing intelligible:

"This plow is different from all other plows, inasmuch as the land side is composed of three plates which are fixed over each other, and the lower or under part of the plow is composed of two plates, with other pieces combined and connected, as hereafter described.

"The first land side plate and the under plate are cast together, each in their proper direction or position, which is nearly at right angles.

"The lower part of the land side is so formed as to be of double the thickness of the upper part, so that the upper part may receive the cutter which fits the sunken part and rests on the projecting thickness which forms an angle of about twelve degrees rising towards the back part of the plow.

"At the upper end of the said angular line there is a groove or cavity with a number of indents for the purpose of receiving

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the hooked part of the cutter, by which it may be extended at pleasure when the wearing of the cutter requires it.

"The cutter is a plate of steeled iron, formed to the shape of the plow in front and of a thickness so as to fill up the sunken part before described; the under side of the upper part of the cutter extends in a narrow form having a hook at the end, which bends downwards and catches in the indents before mentioned; when the last mentioned plate or cutter is in its place it causes the surface of the land side to be flush and even.

"Over the above described plates is placed another plate which may be called the shelter plate, as it receives all the wear of the land side; it extends the whole length of the plow, and covers the under structure; the front part partakes of the shape of the cutter and recedes a little from it; it is fastened either by screws or bolts, which make the whole land side firm and secure.

"The plate of the under side of the plow, which is cast with the first plate of the land side, has on its upper surface an indented groove and projects in front of the plow, and forms what is called a nose; this bar, as it wears in plowing, may be extended and turned at pleasure. On the right hand side of the above mentioned groove there is a rising ratchet or toothed edge, the indents of which prevent the under cutter from shifting its situation when in the act of plowing.

"The under cutter is formed of a proper shape to suit the under part of the plow, and is made either of wrought iron, steeled, or entirely of iron; the inner side is bent downwards for the purpose of catching in the ratchets or teeth before mentioned, when wanted to be brought forward, where it wears in plowing. Towards the inner side of said cutter there is a long perforation for the purpose of admitting through it the shapes rising from the cast plate, which fastens the cutter by a key.

"The mould-board is a separate piece, and made of cast iron, having proper staples or bolts in their proper situation for the purpose of fixing it by keys or otherwise; or it may be fixed by screws.

"This new construction of a plow may be adapted to any plow already in use, and the cutters may be made either of steel, wrought iron or cast iron."

What is called the "under plate," in the specification, is a sort of shelf extending across the fore part of the plow from the land side plate to the mould-board; it is about one and a half inches

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above the sole of the land side, and two and a half inches on the mould-board side, so that it slopes towards the land side and towards the point. A flange is cast on each side in which the bar runs which forms the point. The other parts of the plow are described with sufficient clearness in the specification.

This is the first attempt that we have been able to find to meet a want which had been long and which is still felt, of guarding against the rapid wearing away of the point of the plow. This plow was once quite popular in Washington and the adjoining counties, but the difficulties in the use of the sliding point finally overcame the advantages arising from its use, and it finally disappeared from the market. The cases of the patent office are loaded with models showing a great variety of contrivances for an independent sliding and reversible point. The best of these contrivances was probably that of Prouty & Mears, of Boston; at all events, a greater number of these were sold, and they remained longer in use than any other; but at present the agricultural community have almost all gone back to the point cast on the share.

The use of two large wooden wheels running upon an axis, upon which the beam rested, is, as we have seen, a very old contrivance; but the single wheel, running by suitable attachments under the fore part of the wheel, is a modern contrivance of which it is generally believed Zadock Harris was the inventor. We are not sure of the fact, but the current of testimony is undoubtedly in his favor. He first attached one of these wheels to one of his own plows in the summer of the year 1820. It is certain that he introduced their use into the northern part of New York.

On the first of September, 1819, Jethro Wood, of Scipio, N. Y., took out a patent for his improved plow. This contained his most mature views upon the subject, and describes the pattern from which he never afterwards varied. Very large numbers of plows were made from patterns furnished by him, and even to this day there are many plows made in various parts of the country which depart very slightly from the principles established by him. If we are not mistaken, the plow known as the Livingston county is an example of this class.

Jethro Wood was born, we believe, in Westchester county, New York, and in early life removed to Scipio, Cayuga county, in that part now known as the village of Aurora. There was a

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large number of the Society of Friends settled there, which probably induced him to select this location, he being a member of that society. There was much social visiting among them, and as they were all engaged in agricultural pursuits, this was naturally the leading subject of conversation at these gatherings. Roswell Towsley, Matthew Patrick, John Swanm, J. Morgan and J. B. Harris, all patentees of plows and all members of the Society of Friends, were also residents of Aurora. It was natural that daily association with men of this stamp should turn his mind to speculations upon the best form of the plow. He was not, as is generally supposed, a manufacturer of plows; we are assured upon the highest authority that he never made a plow in his life; he made the patterns only, and sold rights to manufacture them. Fig. 64 is an accurate copy of the figure drawn by him and deposited in the patent office as an illustration of his views of the best possible plan for the mould-board of a plow, and in connection with the specifications which we give in a somewhat abridged form will, we trust, convey a clear idea to the mind of the reader of his views upon the subject.

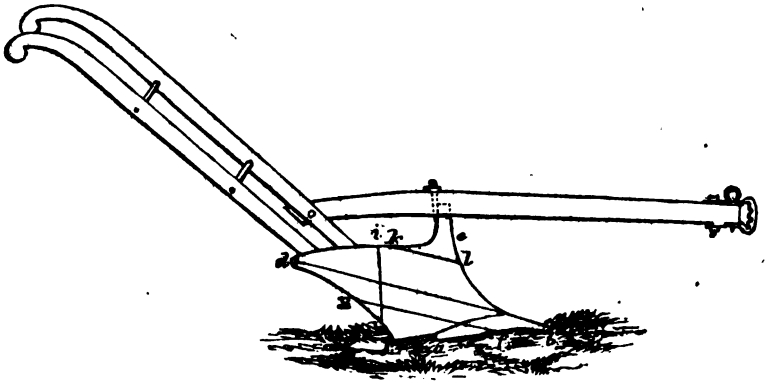

Fig. 64.

First Specification.—The mould-board: This may be termed a plane curvilinear figure, not defined nor described in any of the elementary books of geometry or mathematics, but an idea may be conceived of it thus: The land side of the plow measuring from the point of the mould-board, is two feet two inches long. It is a straight lined surface from four to five and a half inches wide and half an inch thick. Of the twenty-six inches in length, eighteen inches belong to the part of the plow strictly called the land side, and eight inches to the mould-board. The part of the mould-board comprehended by this space of eight inches is very

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important, affording weight and strength and substance to the plow, enabling it both to sustain the cutting edge for separating and elevating the soil in swards, and likewise the standard for connecting the mould-board with the beam. The figure of the mould-board, as observed from the furrow side, is a sort of irregular pentagon or five sided plane, though curved, and inclined in a peculiar manner. Its two lower sides, *b a* and *a c*, touch the ground, or are intended to do so, while the three other sides, *c d*, *d e* and *e b*, enter into the composition of the oblique or slanting mould-board overhanging behind, vertical, midway and projecting forward. The angle of the mould-board, as it departs from the foremost point of the land side, is about 42 deg., and the length of it, or in other words, the first side, *a b*, is eleven inches. The line of the next, or the second side, *a c*, is nearly but not exactly parallel with the before mentioned right lined land side, for it widens or diverges from the angle at which the first side, *a b*, and the second side, *a c*, join towards its posterior or hindermost point as much as one inch; hence the distance from the hindermost point of the mould-board at the angle of the second and third sides, *a c d*, directly across to the land side, is one inch more than it is from the angle of the first and second sides directly across. The length of the second side, *a c*, is eight inches. The next side, or what is here denominated the third side, *c d*, leaves the ground or furrow in a slanting direction, backward, and with an overhanging curve exceeding the perpendicular outwards from thence to six inches, according to the size of the plow; the length of this third side is fourteen inches and one-half. The fourth side, *d e*, of the mould-board is horizontal, or nearly so; extending from the uppermost point of the third side to the fore part or pitch is eighteen inches. The fifth or last side, *e b*, descends or slopes from the last mentioned mark, spot or pitch to the place of beginning.

At the low and fore part of the mould-board, where it joins the land side, its length is thirteen inches. * * * * * * The peculiar curve has been compared to a screw auger and to the prow of a ship, but neither of these similitudes conveys the fair and proper notion of the inventor. It has the following properties: A right line drawn by a chalked string, or by a straight ruler, diagonally or obliquely upwards and backwards from a point two and a half inches above the lip or extremity of the mould-board to the angle where the third and fourth sides

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of the mould-board join, which is shown in the figure by the line *b d*, touches the surface the whole distance in an even and uniform application, and leaves no sinking or protuberance in any part of the distance, so, at a distance half way between the diagonal line just described and the angle between the first and second sides, a line, *f g*, drawn parallel to the diagonal line already mentioned will receive the chalked string as on a uniform and even surface. In like manner, if a point be taken one inch behind the angle connecting the second and third sides, and a perpendicular, *h i*, be raised upon it, that perpendicular will coincide with the vertical portion of the mould-board in that place; or, in other words, if a plumb-line be let fall so as to reach a point one inch behind the last mentioned angle, then such plumb-line will hang parallel with the mould-board the whole way; the line of the mould-board there neither projecting nor receding, but being both a right line and a perpendicular line.

Moreover, if a right line be drawn from a point on the just described perpendicular, one inch or thereabouts above the upper margin of the fourth side, and from the point to which the said perpendicular, if continued, would reach, if the said J. Wood repeats a right line, *k l*, be drawn downwards and forwards, not exactly parallel to the diagonal herein already described, but so diverging from the same that it is one inch more distant or farther apart at its termination on the fifth side of the mould-board than at its origin or place of beginning, such line so beginning, continued and ended is a right line parallel to the mould-board along its whole course and direction, and the space over which it passes has no inequality thereabout.

If the mould-board be measured and proved vertically and obliquely by the saw in fashioning it, and by the rule in meeting it, and by the chalk line in determining it, the capital and distinguishing character of right lines extending on, over and along the peculiar curve which his mould-board describes is always and inseparably present.

Second Specification.—A cast iron standard for connecting the mould-board with the beam: It rises from the fore and upper part of the mould-board, being cast with it, and being a projection or continuation of the same from where the fourth and fifth sides meet. By a screw-bolt and nut properly adjusted above the top of the standard, and acting along its side, assisted, if need require, by a wedge for tightening or loosening, the beam may be raised

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or lowered, and the mould-board, with its cutting edge, enabled to make a furrow of greater or smaller depth, as the plowman may desire; and a latch and key fixed to the beam, and capable of being turned into notches and grooves or depressions on one edge or narrow side of the standard, serves to keep the beam from settling or descending. By means of the screw-bolts, wedges, catches and keys, with their appropriate notches, teeth and joggles, the plow may be deepened or shallowed most exactly.

Third Specification—Claims the share.

Fourth Specification—Claims securing the handles to the mould board and land side of the plow by means of notches, ears, loops or holders, cast with the land side and mould-board respectively, and serving to receive and contain the handles without the use of nuts and screws.

Fifth Specification—Claims an improvement in the method of adjusting the cast iron land side to the cast iron mould-board. Their junction is after the manner of tenon and mortise—are joggled or dovetailed together in the casting operation—so as to make them hold fast. The fore end of the tenon is additionally secured by a cast projection from the inside of the mould-board, formed for its reception, and if any other tightening should be requisite, a wooden wedge well driven in will bind every part effectually without the assistance of screws.

Finally—He claims the right of varying the dimensions and proportions of his plow, and of its several sections and parts. A disclaimer of certain portions of these claims was entered February 24th, 1838, and another disclaimer of certain other parts was entered on the 26th of May, 1838.

There can be no doubt that this plow became very popular among farmers, and did more to drive out the wretched and clumsy plows of the olden time than any other which had then been invented. As late as the year 1820, a writer in the Rhode Island American says that, in most parts of Massachusetts, the Old Colony plow, with ten-foot beam and four-foot land side, were still in use; and the Sutton plows, which he says "are not fit to plow any land that has sod on it; your furrows stand up like the ribs of a lean horse in the month of March. A lazy plowman may sit on the beam and count every bout of his day's work. Besides, the great objection to all these plows is that they do not perform the work well, and that the expense is enormous for lacksmith work. Six of these plows cost me, on an average, last

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year, five dollars each to keep the shares and coulters fit for work, and the wear of the other parts could not be less than one dollar more—six dollars per year for each plow." It was the merit of Wood that he was more successful than any of his predecessors in driving out the cumbrous forms of the plow above described, and in forming a taste for lighter, better and cheaper implements.

There were sold in the city of New York of Wood's plows, in the year 1817, 1,550; in the year 1818, 1,600; in the year 1819, 3,600. We are informed that the sale largely exceeded the last mentioned number in the year 1820, but we cannot obtain the exact figures. These sales very largely exceeded the sale of any other plow then in existence.

The first use that we have been able to ascertain that was made of the dynamometer in this State was at a trial of plows at Mount Vernon, New York, on the 20th of November, 1820. The width of the furrow was ten inches, but the depth is not stated. The power required by Henry Burden's plow was two and a half hundred weight; by George Woodward's, two and a half hundred weight; by John C. Stevens', three and three quarters hundred weight; by Jethro Wood's, three and a quarter hundred weight; and George Nixon's, three and a quarter hundred weight.

It is alleged that Mr. Wood not only made no profits by his efforts to improve the plow, but that he actually lost large sums by his enterprise. His daughters have repeatedly applied to Congress and to the State Legislature for compensation, but hitherto the application has been unheeded.*

It is evident that Mr. Wood had no claim as the inventor of a cast iron plow, because he had been anticipated in this by Newbold and by several others. He could not claim the vertical straight lines, as he had been anticipated in these by Jefferson and Small. He could not claim the straight transverse line, *d b*, Fig. 64, for Col. Pickering had laid down this line long before him on theoretical grounds, and Jefferson, without any theory, had adopted it in practice. Mr. Wood's claim must therefore rest on the straight lines *h f* and *b l*, which, we believe, fairly belong to him.

In the year 1817, Mr. Edwin A. Stevens, of Hoboken, turned his attention to the plow. He had seen Newbold's plow, which first drew his attention to the subject. He made a mould-board

* Since writing this Report, the N. Y. State Legislature appropriated two thousand dollars to the heirs of Mr. Wood.

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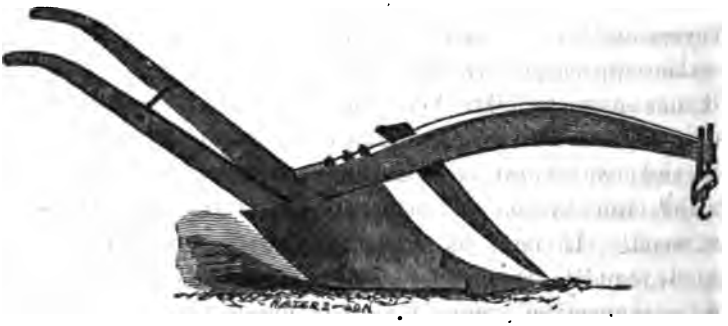
according to his ideas of what was needed for good plowing, and then plowed with it in some very sharp sand which he found on the shore of Hoboken. Noting the parts which did not at once polish, he continued to change the twist of his mould-board, testing it constantly in this way until he found that it would polish all over and in all parts alike. He was then satisfied that he had the best plow that was attainable, and had his castings made from this pattern. But he did a much more important service to plow makers and farmers by inventing the process of *cold* chilling the base of the land side and the lower edge of the share, ignorant that the same thing had been done by Mr. Ransom, in England. This discovery constitutes an era in the progress of the plow in this country. Mr. Stevens had a very good dynamometer with which he made many experiments.

In the year 1819, Henry Burden, since so celebrated as the inventor of cut spikes and horse shoe machinery, was a young man who had just arrived in this country from Scotland. He brought letters of introduction to the late Patroon, Gen. Stephen Van Rensselaer, who informed him that the plow in this country was still in a very imperfect condition, and advised him to turn his attention to its improvement. Mr. Burden acted on his advice, and constructed a plow which was a decided improvement upon all that had preceded it. It retained the principle of



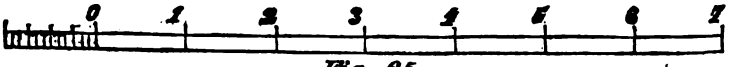


Fig. 65.

vertical straight lines, but was quite unlike both Small's and Wilkie's. Many hundreds of them were sold, but as an opening was then made for Mr. Burden to enter into a much larger and more lucrative business, he relinquished the manufacture of plows. A cut of the implement is given in Fig. 65.

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Mr. Burden never made a plow which exactly conformed to his own ideas of the true form, being restrained by the prejudices of the farmers, who required a longer and heavier plow than he deemed necessary. In all the trials that were made with this plow in competition with others, it was found to do better work with less power than any other. It was all of iron except the beam and handles; its use extended as far as Richmond, in Virginia.

Many other plows were patented and many were made and sold without being patented, which varied very little in their general principles, but which founded their claims on public favor upon some very slight real or fancied improvements. As they soon went out of use it is unnecessary to describe them in detail.

David Hitchcock, of New York, constructed a plow which he patented July 16, 1823, which was very popular, and continued to have a large sale for eight or ten years. These plows were of cast iron, and were much shorter than those now in use. They were better adapted for stubble than for sod plowing, though they did fair work on sod land—at least it was considered good in that day; they would not be as well approved at present. He made seven sizes. None of these plows would work well at a greater depth than five inches; the best work was done at four inches. It was largely used in New York, New Jersey and Canada, but most within a circle of forty miles radius, of which Worcester, Mass., was the centre.

About this period the Hingham self-holding plow became very popular in Norfolk and Plymouth counties, in Massachusetts. It is the first attempt that has come to our knowledge of a deliberate effort to make a self-holding plow, and for this reason we notice it, although it soon went out of use. It had an oblique beam, set strongly to land, on the forward part of which a strong iron axle was bolted transversely and at right angles to it; on the left end a small wheel ran on the grass, and on the right end a larger wheel ran in the bottom of the furrow, which arrangement prevented it from canting to either side. On this axle rises an arch, through which and through the axle a perpendicular shaft passes down near the bottom, having a drum, four inches in diameter and five inches long, which, rolling against the edge of the slice being cut, gauges its width.

Mr. Joel Nourse, who is one of the most successful improvers of the plow of the present generation, having made and sold more

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approved plows than any other man in America, if not in the world, learned the blacksmith's trade of his father. When he was nineteen years old, his father gave him his freedom, and entered into partnership with him in the year 1827. He forged the shares, coulters and other iron work for the old fashioned wooden mould-board lock share plows of half a century ago. They employed an expert wheelwright to make the hard wood or oaken mould-boards and other wood work of these plows. This was in the town of Shrewsbury, Mass., six miles from Worcester. Mr. Nourse had a keen eye, a quick ear, and a dexterous hand. Always on the look-out for improvements, nothing in the action of the plow escaped his observation. The shop was a frequent resort of farmers, whose conversation naturally run much on the form and construction of the implements which were being manufactured under their eyes, and which, in the finished state, were all around them. Mr. Nourse carefully treasured up the hints which, from time to time, were dropped around him, endeavoring constantly to realize them in practice. In this way the real theory of the plow began gradually to dawn upon him, and the constant improvements which he introduced caused a rapidly increasing demand for his work.

After his father's death he removed his establishment to Worcester, establishing himself there in a wider field of business Cast iron mould-boards were now getting into general use, though many farmers still were prejudiced against them, fearing that they would poison the land and increase the growth of weeds, and that they could not be relied on to stand the wear and tear of plowing.

A foundry, which was the first and the only one in New England, had been fitted up at Hartford, Conn., expressly for the casting of these plows. Mr. Nourse was accustomed to go there in a two horse lumber wagon and buy a load of these castings of the Jethro Wood and Hitchcock patterns, though there was much the greater proportion of the latter. These he would bring to Worcester, and having fitted them with beams, handles and all other needful appliances, he sold them out in a finished form. After he had been some time established in Worcester, his business increased so much that he took in Mr. Mason, his brother-in-law, as partner, in the year 1837, and soon after this they admitted Mr. Ruggles, a brother of Judge Ruggles, of Maine, as a third partner, the name of the firm being Ruggles, Nourse & Mason.

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The new firm began, in the year 1840, with making a series of plows of different sizes, in strict accordance with Mr. Jefferson's principle; but these had but a very limited sale, as they were found to be very deficient in turning qualities, though they answered very well in stubble land. On the failure of this speculation, Mr. Nourse determined to remedy the difficulties which he found in existing plows, and apply to the new implements all the knowledge and skill which he had acquired in the course of his experience. In order to accomplish this he took a sheet of thick lead and patiently cut and hammered upon it until he brought it to a form which his judgment approved.

The plow thus made was distinguished from others chiefly in two respects. First, by the greater length of mould-board, and second, by a nearer approach to straight lines in a longitudinal direction. The most of the plows of that day had extremely short mould-boards, and very few of them made any approach to straight lines in any direction.

The Eagle plows, as compared with others in the market, were very long; they had more turn of mould-board at the rear end and a greater intensity of twist beyond the perpendicular. He was induced to pay particular attention to this point by the failure of the Jefferson plow to invert the furrow slice, but he found the unexpected result that, in accomplishing this object, he effected at the same time a much more complete pulverization.

The plow thus made from the lead pattern was the famous Eagle No. 2, and was finished in the year 1842. This plow retains its popularity to the present day, large numbers of them being still sold.

Finding this to be a very good and serviceable plow, he next made Eagle No. 20, and rapidly thereafter various other sizes of the Eagle were made, which are still popular, and are shipped to every part of the world where our commerce reaches.

From the year 1841 to 1861 the sale of these plows reached 25,000 annually.

The Eagle No. 2 was the only pattern of this series which was modeled in lead, the others being worked out of the wood with more or less theory based on the Eagle No. 2 as the ground work.

In the year 1845, Governor Holbrook, of Vermont, began to aid Mr. Nourse in the planning of his plows. The latter had never been able to devise any system that would make the straight

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lines come accurately, both vertically as well as longitudinally, but Governor Holbrook devised a system by which, if the longitudinal lines are carefully laid down upon the pattern, the vertical lines will be certain to come right.

In 1841 Mr. Nourse went to Boston and opened a large ware house, the style of the firm being the same in both places. Some years later other parties were admitted into the firm, under the style of Ruggles, Nourse, Mason & Co. The firm dissolved in 1855, all the old members except Mr. Nourse retiring, and a new firm was formed under the style of Nourse, Mason & Co. This firm, under its various changes, have sold more plows than any other in the United States. Fig 66 represents Eagle No. 2.

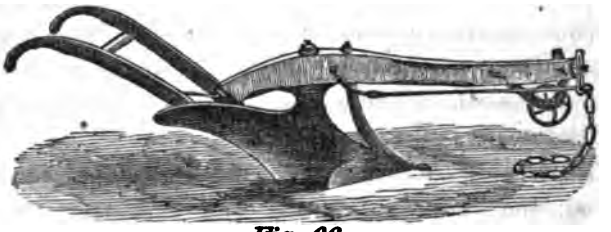

Fig. 66.

It is adapted to turn furrows from four to seven inches deep by twelve to fourteen inches wide. It was sometimes rigged with a common coulter for flat furrow plowing, and sometimes with a fin share, which adapts it for stubble plowing.

We insert, as a contribution to the history of the plow, the following letter, from Mr. J. Dutcher, of Durham, N. Y., addressed to T. B. Wakeman, of New York:

"The history of the plow in America, for the last forty years, has been so identified with that of my own, that in speaking of the plow I shall often have to say something about myself. I have always considered the plow the most useful and necessary implement that man has anything to do with, for this reason, I have bestowed upon it a great amount of time, labor and money.

"As early as the year 1806, when I was but a lad, I began to observe the difference in the constructions of the plow. At that time there were two kinds in use; one was called the Hog plow, which was said to be of Dutch origin, and another called the Bull plow, a Yankee invention. About this time I was learning the blacksmith trade, and had considerable to do with the plow, in constructing and making that part of it called the share. The Bull plow was the most esteemed; the other went out of use

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about the year 1809 or '10. The cast plow, with wrought share, was known in and about Albany and adjoining counties. It is said to be Mr. Peacock's patent. But I considered all that I saw awkward and complicated, not simple enough for general use, but such as they were, I made and sold, like the other plow makers. In the year 1818 I heard that there was a new plow got up by Jethro Wood, and as the plow was rather my hobby, I took the trouble of going some twenty miles or more to see it. But when I come to see and examine it I found it to be complicated, weak and short-lived, yet it was different from those heretofore used—composed of three parts, a mould-board, land side and share. The mould-board was too short and too full on the external surface, and otherwise not properly shaped. Its entering wedge, or first part of the plow was too low and did not turn the furrow upon the edge in proportion to its entering the ground; in anything like quick speed the furrows were broken and deranged.

"The land side was too narrow, long, and too weak, and did not protect the front edge or part of the mould-board on the land side and was too straight on the bottom; the share was far from being right; it left the shin of the plow all unprotected. In April, 1819, I planned a plow which I supposed better adapted to do the work, as it afterwards proved itself to be. This plow I did not patent until 1832. Owing to the bad management in Washington I lost my first $30. Not having my specification at hand, I will describe my improvement at that time, April 15, 1819. The mould-board was longer than any I had known. It was concave, with a corresponding shape. My land side I made twice as wide as Wood's—six to seven inches—and connected it to the mould-board by two wrought iron bolts. My share, in which consisted my greatest improvements, was constructed with a projecting piece called a shin share, so made as to supply with a new edge the shin of the plow as well as the wing. By this improvement, which has been adopted by all plow makers, the plow was more durable by one-half. The making of the land side concave on the bottom, although about half an inch from the point to the heel of the plow, was a very simple but an important improvement. The mould-board back of the wing of the share did not touch the ground by half an inch. The two improvements are quite necessary in rough and stony lands. Wherever my plow was introduced it superseded Mr. Wood's. The result was a prosecution by Mr. Wood for an infringement of his patent.

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He tried the second time, but was unsuccessful in both. About 1821 persons in different parts of the country got up plows. Among them were Mr. Tice, of Washington county, Mr. Wright, of Saratoga, Mr. Chamberling, of Dutchess, and several others in different parts of the Union. They all laid aside theirs and adopted my improvements. I found it impossible to protect myself from these encroachments. Although my plow was made by all plowmakers, yet I did not consider it perfected. In 1823 I ascertained that my land side was not as durable as it ought to be. By not extending all the way outside to the share, it left part of the mould-board exposed to wear and could not be renewed without getting an entire new mould-board. To remedy this I extended the land side outside of the mould-board up to the share. Finding that the wrought standard I then used was not sufficiently strong and cheap, I, in 1823, extended the body of my cast mould-board up to the beam, securing the beam to the body of the plow by a wrought bolt from the centre of the land side and mould-board perpendicular through the casting on which the beam rested, and through the beam, securing it with nut and screw. These have also been generally adopted. One more improvement remained to be made. In my letter to the Secretary of the American Institute, published in the journal of the Institute in 1837, I said that the mould-board, beam and handles of all the American plows were too short. I had been convinced of this years before. About 1838 I adopted these alterations. The plowmakers all followed suit. Owing to the imperfection of the patent law I had little encouragement to patent my last improvements. One clause in the patent law of 1836, which declared that a patented article must not bear sale at the time of the issue of the patent, and that there must not be more than one year from the date of the improvement before the patent is taken out, deprived me of my rights to my improvements.

"My large size plow that takes a furrow seven inches deep by fourteen wide, turns over six and three-quarter inches more at the top edge of the mould-board than at the bottom. From all that I have discovered in twenty-five years of observation and experimenting, I have not found one straight line that I could recommend on the running part of the plow. Although a plow will run well in its perpendicular position if the land side is straight, yet it will run better if it be even one-eighth of an inch concave towards the land. In no case should it be rounding.

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"There are other points that should be kept in view, particularly the line of draft, compromised in the height of the horses' breast, and of the end of the beam and its length. I know plowmakers who are unacquainted with this essential principle. When the land side is straight on the bottom from point to heel, the end of the beam must be one inch or more higher in order to make it enter, particularly in rough or hard land. This inch in the forward end of the beam places it thus much above the line of draught. In drawing, the team pulls the beam down, causing the plow to run on the point, and causing it to run unsteady, and, as farmers say, to root the ground. The half inch concave on the bottom will enable the plowmaker to fix the beam below the line of draught, which will make the plow run flat, and not rendering it liable to tip up behind when meeting with obstructions. This principle, as simple as it is, gave my plow a decided preference. The proper length of the beam is important, and often overlooked. Although smooth, mellow soil requires some variation in the plow from that designed for hard and stony land, yet for land in general two or three inches in the beam makes great difference in the running, throwing the end out of the line of draught. The length that I have found as generally best for an half inch concave is two feet two inches. I place my plow on a straight place, then measure the perpendicular from the point of the plow to the beam; then from this point two feet two inches to the end of the beam. For hard ground, two feet, and for mellow soil, two feet four inches are the extreme lengths.

"Owing to the ignorance and prejudice of farmers it has cost me more labor to introduce my plow than to make the improvements. These difficulties were aggravated by having my improvements pirated by almost every plowmaker in the country. The province of Congress is to give protection to the real inventor, not to convey his improvements to another. Every farmer has a right to his own field and its products; equally inalienable are the rights of inventors.

"My long experience in the construction and great familiarity with the use of the plow have led me to comprise the excellencies of the plow in seven essential points—materials, strength, draught, expense of first construction, workmanship, yearly expenses and performance. A deficiency in one of these may make the plow comparatively worthless.

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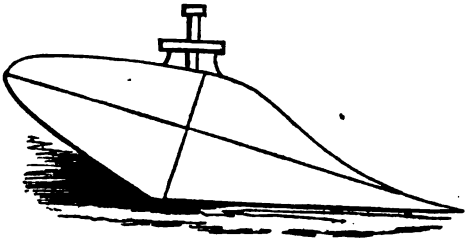
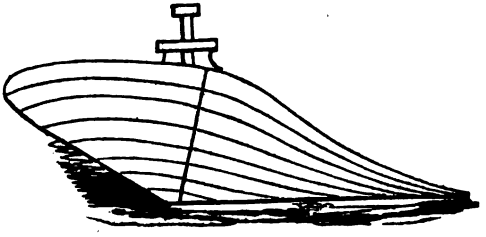
"Mr. Wood lays it down as a scientific principle that the lines of draught of the mould-board should be as shown in A; that is, beginning at the point of the share, draw a straight line to the upper edge to the mould-board behind, that the straight line should rest upon the external surface of the mould-board all the way up to the upper edge of the mould-board behind. This, he says, is the line the furrow follows. Now I assert that this is not in accordance with the natural operations of the furrow as it rises and turns from its horizontal to its perpendicular and inclined position. Practical experience has shown me that the surface of the mould-board should be a curve as shown by a straight line drawn from the forward point on the lower side of the mould-board diagonally to the upper end. This line will be one inch above the surface in the middle. Lines drawn at right angles in this line will be one-quarter of an inch above the surface. The furrow will follow the curved lines indicated in cut B.



A

"The time and money I have expended on the plow are equivalent to $5,000. The advantages the public have derived can be estimated by hundreds of thousands, while my returns have not exceeded $1,000. Plowmakers have paid to Jethro Wood sums that should have come to me, the real inventor of the improvements. This was done in consequence of improper laws passed by Congress in his favor.



B

"In Mr. Jefferson's letter to Sir John Sinclair, in 1798, you will find Mr. Wood's mould-board described. In Ransom's History of Agricultural Implements, Johnson's Encyclopedia of Agriculture, and in the English journals since 1800, you will see that Robert Ransom invented a cast iron share as early as 1785. He also invented the process of chilling the point of the share. A farmer in Suffolk, England, made, in 1790, cast land sides. Mr. Newbold, of Orange county, in this State, made cast plows

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Plate VII.

McCORMICK'S PLOW.

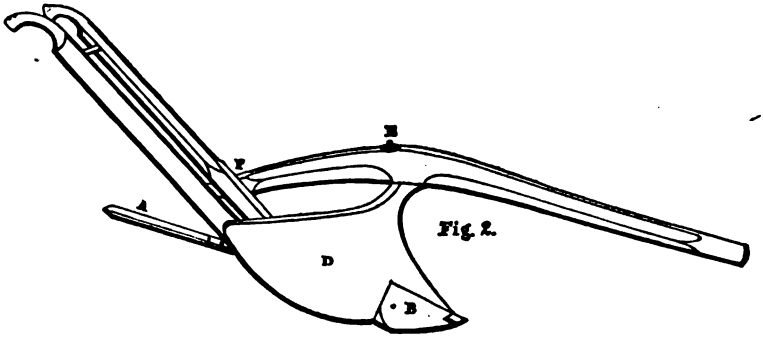
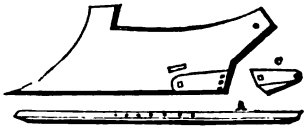


Fig. 2.



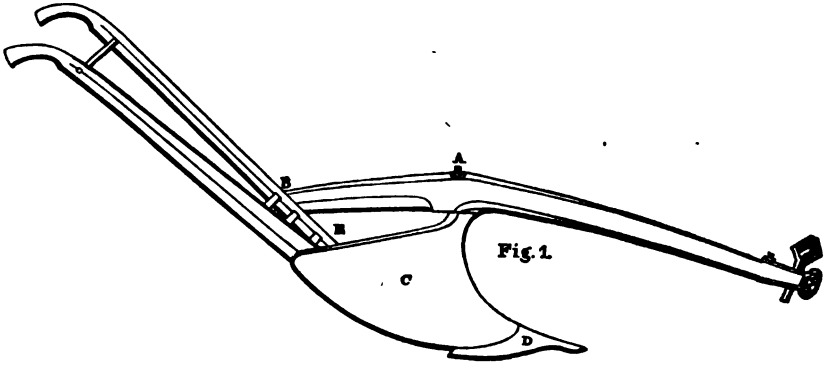


Fig. 1.

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as early as 1790, and patented the invention in 1797. The patent, which I have seen, was signed by the elder John Adams. The casting of this plow went up through the beam like that of J. Wood's. Mr. Peter T. Curtenius of this city had cast iron plows for sale in 1800. They were of three pieces—mould-board, land side and share.

"In 1814, Mr. Wood obtained a patent, again in 1819, and by special act of Congress procured a renewal of fourteen years, making *thirty-three* years in all. He now seeks another renewal!

"J. DUTCHER."

McCORMICK'S PLOW.

This plow was in great reputation and use. The only reason why we have not given a specification of it at large is, that having given Davis' and others at full length, it would take up too much room. There are, moreover, a great many points of resemblance between this and Davis'. A general reference, therefore, to the drawing of it is given in connection with the following extracts from the original specification itself, which show that the improvements consist chiefly in the following particulars, viz. (See Plate VII):

First—In the shape of the bar and point, as well as the shoe or fender to be attached to a wrought or cast iron land side.

Second—In the face of the mould-board, and the method in which it is wrought; the front edge of the mould-board; the curve or projection over toward the land side; the method of making the hole for the brace or bolt through the neck from the hind part, or a ketch without a hole through; also, the ketch at the bottom of the mould-board to fasten the share on; the concave groove for the handle, and one hole for a bolt to fasten it, and the method of hardening the front edge and wearing of the mould-board.

Third—In the method of fastening the wrought share to the cast land side and mould-board by ketches and projections; the fender or shoe, the concave groove in the land side for the handle to fit it; the structure of the fore part of the mould-board, for the cast share, and self sharpening and advancing point, the brace bar for the bar to rest on, and the method of fastening the bar or point, and its position upon an inclined plane, and the shape of the share.

Fourth—Putting the beam on the outside of the handle, the manner in which they are fitted together, and fastening them with

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a staple and two screw nuts; the adjusting of the beam on the top of the neck of the mould-board and fastening it with one end of the brace or screw bolt, both coming from the hind part and through the neck of the mould-board, with one screw, and raising and lowering the beam at the handle.

Fifth—In the shape of the sword and front edge of the coulter and the method of fastening with the stirrup.

FIG. 1. A—Beam bolt.
B—Fastening by a staple.
C—Mould-board.
D—Share.
E—Adjusting screw brace.

FIG. 2. A—Self sharpening point.
B—Share.
C—Shoe or fender.
D—Mould-board.
E—Beam bolt, hooked at lower end.
F—Fastening by a staple

CHAPTER V.

HISTORY OF AMERICAN PLOWS—CONTINUED.

Mr. John Mears was born in 1795, and was brought up as a plowmaker. In 1831 he became acquainted with David Prouty, a practical farmer and country trader, with a mechanical turn of mind. Mr. Prouty called his attention to the Hitchcock plows, with which he had not previously been familiar. Finding them much better than any they had ever seen, David Prouty, his son Lorenzo and John Mears, formed a partnership for the purpose of making and selling these plows. They sold seven sizes of these, and at once found a very large demand for them.

Mr. Mears had a very active mind, and applied himself assiduously to the study of the plow. He had not long been engaged in this line of observation before he perceived the irregularity of motion which was produced by the oblique insertion of the beam, and he was not long in reasoning out the centre draught principle which we have described in the chapter on "The Line of Draught in Plows," Chapter VIII. This has been one of the most important improvements made by American inventors of the plow, and is now almost universally adopted by all plowmakers.

Their mould-board was formed by cutting a strip of sole leather to the width of the proposed furrow; one end of it was nailed to

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a flat surface, and the remainder was twisted over precisely as a furrow would be. The wooden pattern was then cut so as to coincide with the surface of the twisted leather. Prouty & Mear's No. 5½ and No. 30 were formed in this way. They became very celebrated, and large numbers of them were sold. The sales of this firm amounted to about five thousand annually, at an average price of eight dollars. Their self sharpening points were probably the best that were ever made. The first prize, at the great trial in Albany in the year 1850, was awarded to these plows.

Messrs. Minor and Horton began to make what is known as the "Peekskill Plow" in the year 1835. Mr. Minor had been an employee in the establishment for nine years. The first plow patterns made at Peekskill were by James H. Conklin, while an apprentice with Levi Carpenter in 1823. They were known as L. C. plows, and had two points to the share, a few of which are still in use. The next was made by Stephen Gregory, which was known as the Gregory plow; these were made in 1826. The next were made by the same J. H. Conklin, who had formed a copartnership with James Wiley; these were made in 1827, and were called the Wiley & Conklin plow. These suited the market well, and large numbers of them were sold of seven different sizes. About the same time Truman Minor, who was the superintendent of Seth Hait's foundry, made a set of patterns for four different kinds of plows. Shortly after this Mr. Hait died, when Frost Horton and Truman Minor formed a partnership as above stated, and having taken Mr. Hait's foundry, began the manufacture of the "Peekskill Plows," of nine different sizes. In the year 1855, Mr. Minor retired from the firm, and died in the year 1862. On his retirement the firm assumed the style of Horton, Depew & Sons, which continued to manufacture the same kind of plows until 1864, when they sold out the business to J. B. Brown and I. L. Paulding, who formed a stock company known as the Peekskill Plow Company.

This company, since its first formation and under various names, have made patterns for about ninety different forms of the warped surface which Mr. Minor originally devised. They have, during that period, made about one million sets of castings, and it is estimated (though on unreliable data) that about half as many more have been made from patterns taken from these castings by others.

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Mr. Minor made a semi-cylinder of the length of the proposed plow, and of the same diameter as the width of the proposed furrow; the cylindrical surface was divided in both directions by lines one inch apart. A line beginning at the left rear corner was traced diagonally through the corners of the squares to the right front corner; the line thus formed was applied from the point of the share to the rear upper wing of the mould-board, and the pattern was worked down until it accurately coincided with it; there is a series of straight lines also in this plow running from front to rear. Such is the description of the principles of the Peekskill plow given us in the year 1850 by Mr. Minor. We wrote to Mr. Brown, of the Peekskill works, to know whether our recollections were correct. He replied as follows: "Your statement of the principles of Mr. Minor's plows expresses his ideas, as far as it goes, as well as they can be briefly expressed by words, but it seems to me to convey no idea of the helicoidal torsion which, being moderate, constitutes the 'easy lines' of Mr. Minor's plows."

The Peekskill plows have transverse straight lines, as we have before stated. The first or lowest of these in the No. 21 plow makes an angle of 21 deg. with the plane of the sole. The upper line is very nearly horizontal; the intermediate lines differ in the angle which they make with the plane of the sole by regular gradations; if they are produced backward they would *approximate* to the form of a fan, but they do not radiate from a common centre. The lines running from the bottom to the top of the plow also vary in the angles which they make with the vertical line which in this plow is situated about five inches in front of the extreme rear angle of the mould-board. The first of these lines forms an angle of about 40 deg. with the vertical, and they regularly increase as they approach the vertical. The length of this plow from the point to the extreme rear angle of the mould-board is thirty-five and a half inches; the length of feather fourteen and a half inches; distance from land side to the point of the feather, ten inches; length of land side twenty-seven inches; distance from sole to under side of the beam at the standard, fourteen inches. A figure of this plow is given in Transactions of the New York State Agricultural Society for 1850, page sixty-one. There can be no doubt of the great excellence of this plow; its chief defect is, that its curves are too regular, and therefore it fails in pulverizing

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power; but its draft is very easy. It won the second prize in the great trial at Albany in 1850, in fallows and in stiff sods.

It would be very improper to pass over the labors of the celebrated Daniel Webster, in a report on the history of plows. He invented in the year 1836 or 1837, a plow for work twelve and fourteen inches deep, which is still in existence, the property of his life-long and highly esteemed friend, Peter Harvey. It is twelve feet long from the bridle to the tip of the handles; the land side is four feet long; the bar and share are forged together; the mould-board is of wood plated with straps of iron; breadth at the heel of the mould-board to land side, eighteen inches; the spread of the mould-board was twenty-seven inches; the lower edge of the beam was two feet four inches above the sole; width of share fifteen inches.

The history of this plow is so admirably stated in a letter from Gov. Holbrook, of Vermont, that we give it in his words. "I have certainly been faulty in recollection, in that I have not before now, given you an account of what I personally know of the efforts of the late Daniel Webster, to improve the plow for deep thorough plowing. My memory was jogged in this regard by a question put to me in a letter received from a friend, yesterday, touching this matter; and, therefore, I now write to give you an account of Mr. Webster's great plow.

"You doubtless know that Mr. Webster was passionately fond of farming and rural life, of farm stock, and especially large, sleek, superb oxen, of which he always kept several yokes (as we say in Yankee phrase) or pairs for the work of the farm at Marshfield. He not only himself raised the best of large, lusty steers, which were closely matched and trained to the yoke, but not unfrequently he bought working oxen when opportunities offered for securing those which were well matched, well trained, of large size and superior quality.

"In perfect accordance with his thoroughness in everything else, he believed in deep, thorough plowing, and that our farmers were quite too superficial in the tillage of the land. But at that early day there were no plows made that could turn a furrow of more than five or six inches deep. Therefore, he determined to make a plow himself that would give him the depth of furrow he desired in his farming, for a deeper furrow he must have, no matter, he said, if it was a foot deep.

"Accordingly, some thirty years ago or more, he set himself at

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work to plan a large plow, and employed a wheelwright to make the wooden mould-board agreeably to his directions and under his daily personal supervision, and then a blacksmith was employed to cover the mould-board with straps of thin iron in the usual way of strapping wood mould-boards in those days, and to set the wrought iron and steel-edge share, and the lock-coulter, which passed up from the share through the beam, all agreeably to Mr. Webster's directions. Then the wheelwright was directed how to set the beam and handles. Everything must be done precisely as he directed as to landing of beam, pitch and landing of share, etc., and he felt as much interest and enthusiasm in the production of this plow as anybody could.

"The mould-board was immensely large and long, and was constructed substantially on Jefferson's principle of straight lines, but with such modifications and variations in form as Mr. Webster thought best, such as greater length, proportionately, and with more twist or overhang at the rear end, so as more surely to invert the sod in deep plowing. It was constructed to turn a furrow a foot deep and about two feet wide. The beam, of the toughest white oak, was long and of huge strength, sufficient for four yokes of his large oxen.

"When the plow was completed, ready for trial in the ground, Mr. Webster was the first man to hold it, and worked several hours with it, feeling greatly delighted with the capacity of his new plow for deep, thorough work.

"With this huge plow and a strong team the rough tillage lands at Marshfield, and such of the pastures as had become more or less covered with bushes and shrub oaks, small white birches, etc., were deeply plowed and thoroughly turned over and subdued. The bushes and shrubs were cut at the surface of the ground and cleared off the land, and the roots and stumps turned over by the plow.

"I visited Marshfield and Mr. Webster about twenty years ago, when he showed me this plow, explained how and why he got it up, and took me to see a field which had recently been cleared of bushes and shrubs and deeply plowed with this large plow. I remember his making a remark to me, substantially as follows: 'When I have hold of the handles of my big plow in such a field as this, with four yokes of oxen to pull it through, and hear the roots crack, and see the stumps all go under the furrow, out of sight, and observe the clean mellowed surface of the plowed land,

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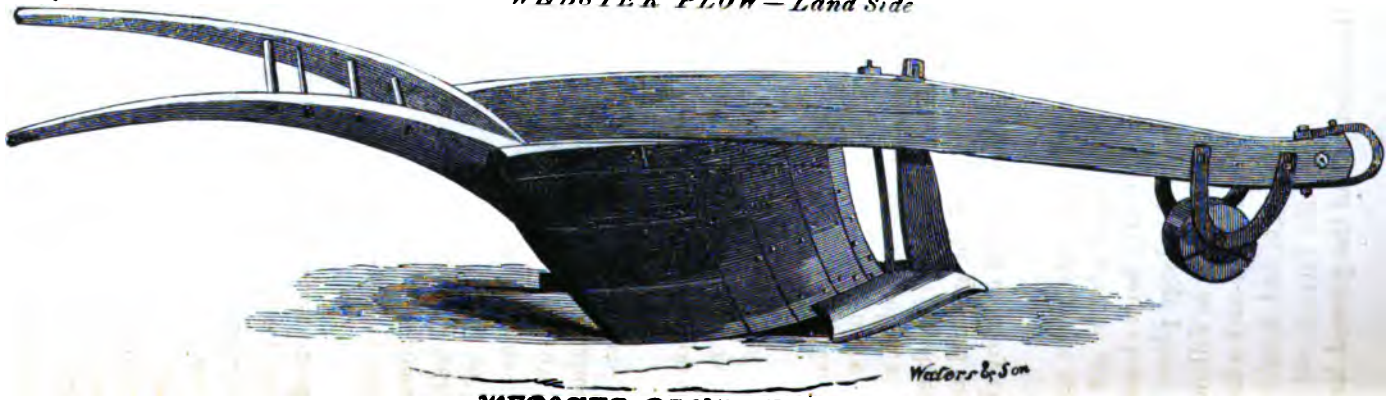
WEBSTER PLOW—Land Side



WEBSTER PLOW—Furrow Side.

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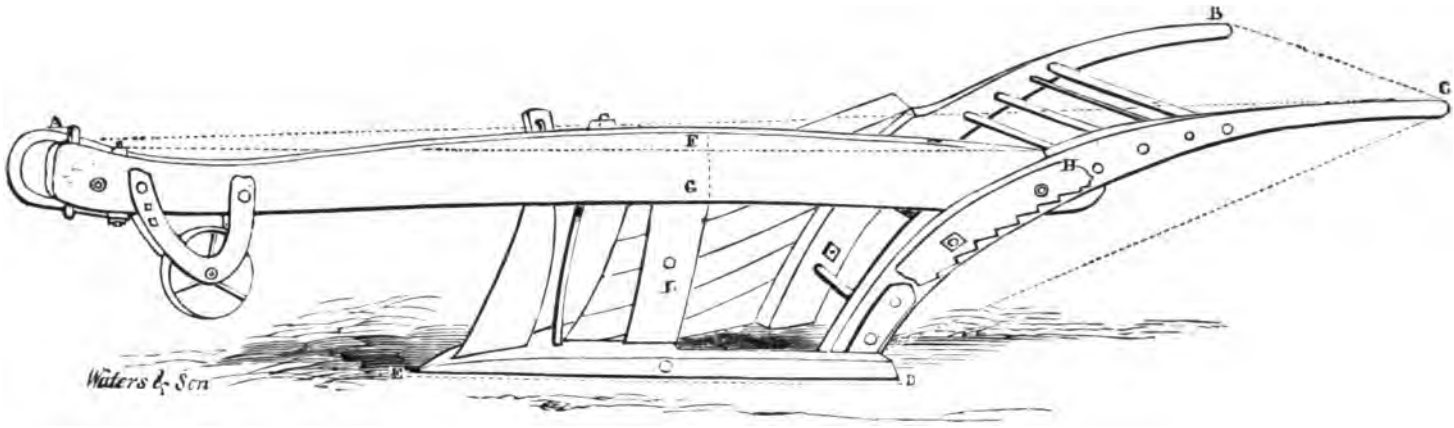

WEBSTER PLOW—Dimensions.

Total length of Plow (from A to C)	13 feet.
Total length of Beam (from A to H)	9 ft. 1 in.
Total length of Handle (from C to D)	6 ft. 4 in.
Distance between the handles (from B to C)	2 ft. 10 in.
Length of Land Side (from E to D)	4 ft. 2 in.
Thickness of Beam (from F to G)	7 in.
Height of Standard (I)	18 in.
Height or width of Mould-board	20 in.
Distance from point of share to extreme end of mould-board	5 ft. 6 in
Width of Share	16 in.

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I feel more enthusiasm over my achievement than comes from my encounters in public life at Washington.' That is the idea, and not far from the language of his remark to me."

The following letter, received after Gov. Holbrook's gives Mr. Harvey's recollections of the history of the Webster plow:

"Boston, *April 18th*, 1868.

"My Dear Sir—I send you, by to-day's mail, the drawings of the Webster plow, together with a sketch, which will give you the means of furnishing an accurate description of its dimensions.

"This plow was manufactured in Mr. Webster's workshop on his farm at Marshfield; the model and plan of its construction was entirely his own, and much of the work was performed by his own hand.

"He had, on his extensive farm at Marshfield, laying near to the sea (upland country), some eight or ten acres, more or less, on which there had been a growth of stunted oak, fit only for fire wood. This had been cut for this purpose; and an undergrowth of scraggy roots, spreading in every direction, had sprung up. It was useless for cultivation as it then was, the roots or stumps too small and too numerous to be removed with an ordinary stump puller, and too strong for any ordinary plow to grapple with. This plow was made to meet the difficulty, and succeeded.

"I have seen the great man holding the plow, assisted by some six or eight farmers, with strong arms, while it was propelled by six pairs of oxen, tearing up roots and everything else that stood in its way, accomplishing a triumph great in its way, as had been often performed by its maker in the many intellectual triumphs in the forum and senate, and apparently giving him quite as much delight.

"The plow proved a success, accomplishing all for which it was intended.

"It is probably the largest plow ever built on this continent.

"Most respectfully, yours,

"PETER HARVEY."

A great number of inventions for subsidiary purposes are recorded in the Patent Office, having for their object some improvement in the clevis, the wheel, the share and various other subordinate parts; but the next really earnest attempt to improve the form of the plow was by James Jacobs, whose patent is dated July 8th, 1834, and is represented in Fig. 67.

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The following extracts from his specification, will explain his ideas:

"The mould-board of cast iron, Fig. 67, from the extreme points of the length of the mould-board, from *a* to *b* a straight

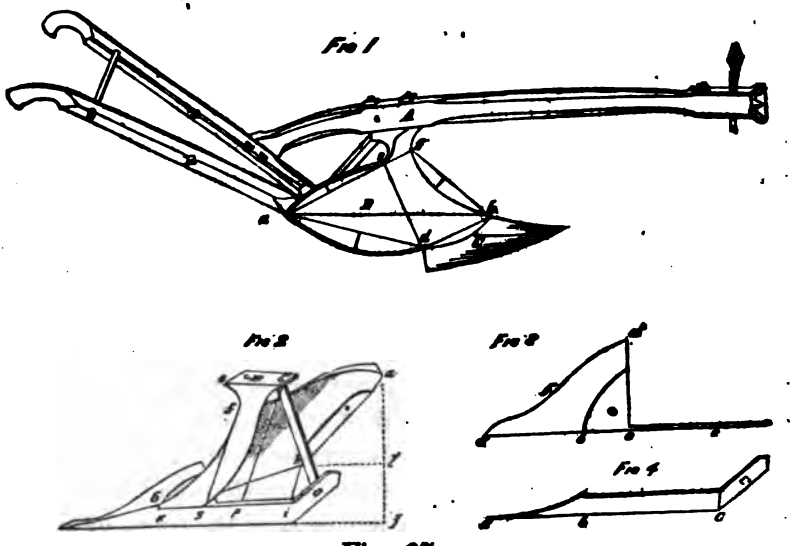

Fig. 67.

line is to be struck from one to the other of six inches and one-eighth in length, and from the middle of this line a perpendicular is to be let fall to the surface of the mould-board, which will be five-sixteenths of an inch. A line is now to be struck from the point *c*, which is to be at the commencement of the thin edge of the mould-board to the point *d*, placed at the shoulder on the under side, for the reception of the extreme edge of the back of the share of two and five-eighth inches in length. From the letter *d* to *a*, a straight line is also to be struck of four and five-sixteenth inches in length; a perpendicular, let fall from the centre of this line to the surface of the mould-board, will be full three-eighth inch in length, and from said point *c* to the hinder circular edge of the mould-board, seven-sixteenths of an inch. From the point *a*, to the point *f*, a line is drawn of four and seven-sixteenth inches in length, and a perpendicular raised from the centre of this line to the top of the circular part of the upper edge of the mould-board will be a full quarter of an inch in length. From the letter *f* to the letter *b* on the front edge of the mould-board a line is to be struck of two and three-quarter inches in length, and from the centre of this line a perpendicular let fall on the front

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edge of the mould-board will be five-sixteenths inch in length. From the point *d* to the point *b* a line is to be struck of two and three-sixteenth inches in length, and a perpendicular raised from the centre of this line to the thin edge of the mould-board will be one-quarter inch in length. The portion of the surface of the mould-board, contained between each point or extremity of these original straight lines struck as above directed, is to be shaped upon that segment or portion of a circle as will be between said point having the perpendicular for the height of the arch; the line *a b* will be the only exception to the rule, and in this particular that three-quarters of the distance across from *a* towards *b* will be described on nearly a straight line, the extremity of the point being a little elevated.

"From the point *k* to the point *g* in Fig. 2, showing a left hand view of the mould-board, the line between these extremities or points will be of one and three-sixteenth inches in length, and another line from the point *f* to *g* will be two and a half inches in length; the point *k* is to drop one-eighth of an inch below a horizontal line drawn from *g* towards *b*. From the point *g* to *b* the length of the line will be one and three-sixteenths inch. From the point *h* to I the length will be one and five-sixteenths of an inch. A perpendicular is let fall from the point *a* to the horizontal plane on which the flat part of the under side of the mould-board rests, designated by the point I, being that of the intersection, and another line at right angles with it, being continued from the point I till it intersects the line running along the face of the slice from *k* to *g*, parallel with the bar, at the point *j* gives a line struck from I to *j* of three inches in length, which gives the correct width of the board behind from outside to outside. On the back of the inside of the mould-board a flat shoulder is formed of about two inches in length, increasing in thickness of the mould-board towards the upper part to about double the width of the average thickness of the mould-board throughout, and thereby presents a flat surface upon which the right handle is bolted. On the line *k g*, as a base, a perpendicular is to be raised through *f* to the point *m g* two and three-quarter inches in height, and another parallel to it at one inch distant of two and nine-sixteenths of an inch in height. The distance from *m* to *o* will be a projection of one-quarter of an inch forwards. The curved line of the front edge of the slice continues its direction beyond *f* about half the distance on to *m*,

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when it projects forward about one-quarter of an inch and is then moulded off to the point *o*, thereby leaving sufficient shoulder for the hole through which the front bolt is to be fastened. On the face of the mould-board, Fig. 1, the concave surface *d* to *e* continues in the same slope to about two-thirds the distance above the neck over the line *f c*, where it projects forward in a concave sufficiently deep for the reception of the head of the front bolt terminating at the top under the beam in a sharp edge, having the corners rounded off. The back part of this head runs back about one-quarter of an inch beyond the curved line of the back part of the slice, thereby leaving space for the insertion of a hole to be cast for the reception of the end of the brace that extends from the heel of the bar to the said hole in the head. This form and arrangement present such a shaped mould or pattern as may be cast at one operation.

"Fig. 3 is a view of the share where a line from the point *a* to the point *c* extends to two and four-eighths inches in length, and a line from *c* to *b* is of three and three-eighths inches in length, and the distance *c* to *e* is one and five-eighths inches along the bar. The width of the share from *e* to *d* is two and three-eighths inches, and the edge from heel to point is sharp throughout. That part between *a* and *f* extending in a circular from *d* to *f*, and the remainder of the point from *f* to *a*, is rounded at the extremity of said point. The depth at *c*, in Fig. 4, of the bar is to be three-eighths of an inch, and at *e* it is to be seven-eighths, and extending back to *b* of the same depth, this share and bar is to be made of wrought iron. These proportions are reduced to one-fourth of a plow of full size, so that in constructing a mould-board of the full size of my 'Smeller Plow' the proportions are to be increased accordingly."

It will be observed that Mr. Jacobs' method is wholly empirical, or, at least, if there is a principle involved in its construction, it is not obvious to us after a careful examination, and none is hinted at in the specification. It consists simply of lines drawn in certain directions, and of specified lengths in a plane and from given points in these lines, letting fall perpendiculars of given lengths, which are ordinates to the desired curve at these points; the points of the curve being ascertained in this way, the remainder of the pattern is cut away so as to form a regular curve with them.

The next attempt to apply mathematical principles to the construction of the mould-board was made by Aaron Smith, of

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Bloomfield, Michigan, who obtained a patent May 10th, 1844. This is the plow which first came into notice as the "Michigan plow" at the great trial by the New York State Agricultural Society, at Albany, in 1850, and which, with some important modifications, is now known as the sod and sub-soil plow, and is one of the best plows in existence for sod lands. A figure of this plow complete is given in the Society's Transactions for 1850. Figs. 69 *a*, 69 *b*, 69 *c*, 69 *d*, 69 *e*, 69 *f*, 68 and 69 represent the plow in detail. Fig. 68 represents the sole; Fig. 69 *f* represents the sole of the share.

The following extracts from the specification will give an idea of the principles involved in its construction:

"Fig. 68 is a plan of the hind plow as I draw it on my working-board when preparing to make a pattern. The numbers on the line *j j*, representing the land side, show the distance between the principal points of the varying outline of the mould-board as

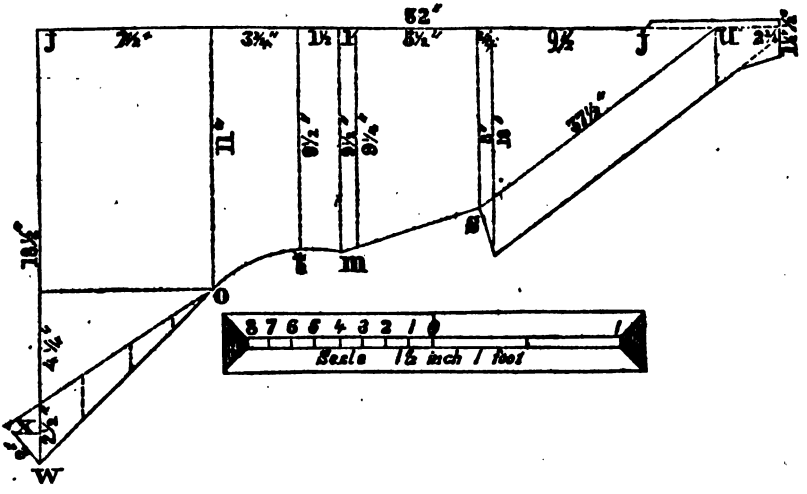

Fig. 68.

marked by the dotted lines drawn at right angles to the land-side and terminating in those principal points. The distance from the face of the land side to these principal points are marked on these dotted lines.

"Fig. 69 is a right-hand or face-view of the mould-board, with the share attached, showing the outline of its respective sides. The line *u l* is erected perpendicularly from the point of the mould-board. The measurements in the dotted lines, drawn horizontally from the perpendicular, give the outline of the head of the board,

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said measurements being taken at the respective distances marked on the perpendicular; the line *m n* is drawn in the plane of the base of the mould-board, and the numbers from the perpendiculars drawn from the line give the outline of the lower side of the end of the board, and also of the top of it as far as the line *o p*;

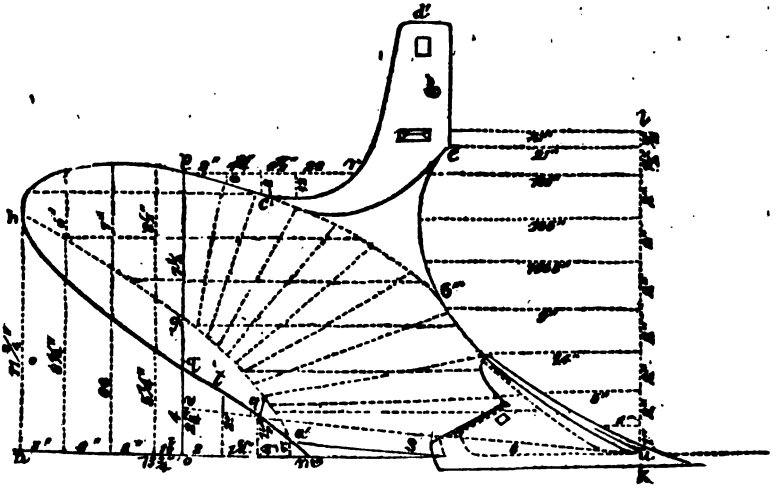

Fig. 69.

and the measurements from the line *p r*, drawn through the point *p*, parallel to the plane of the base of the board, gives its remaining outline to the sheath (generally called the standard). The line *n b′ c′ p* is a guide line in forming the face of the board. The curve, *b c h*, may be determined by the scale of one and a half inches to the foot, which is that to which the respective figures showing the parts in details are drawn. The face of the mould-board was exactly perpendicular, and the line *o p* from *q* to *p* is in it; *o p* is also one of the guide lines in forming the face of the board. The rise of the line of the board from *a′* to *t′* is made at such a rate, compared with the spread of the board, as will exactly preserve through that distance the same width of the plow as at the heel, *a′*. From *t′* to the perpendicular the rise is such that the increased width of the plow (Fig. 68) is to the distance as one to two and one quarter inches, and from the perpendicular to the end of the board these measurements are as one to one. The point, *t′*, being where the action of the furrow slice, following that of the heel, *a′*, commences, I make that a point through which to draw a line from the point of the mould-board, *u*, to the perpendicular. This line also lies in the surface of the board, and as

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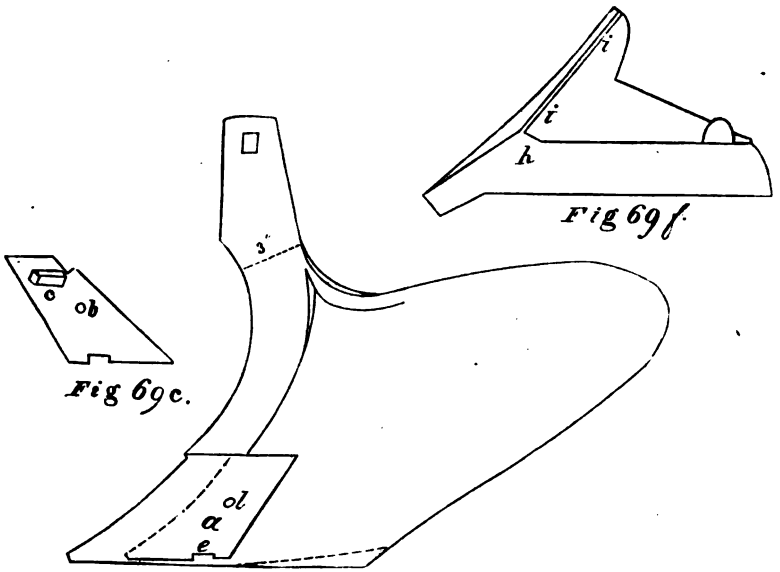

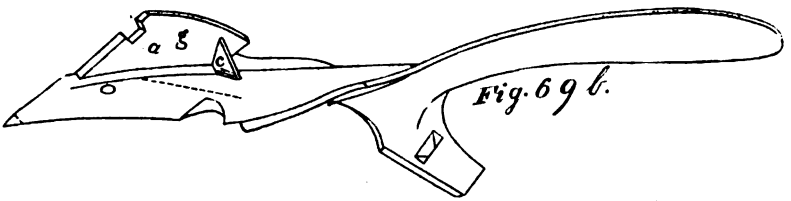

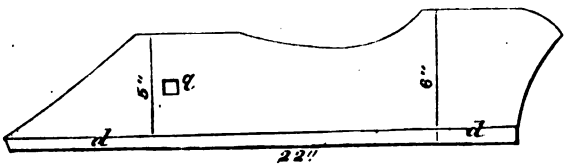

Fig. 69, d.

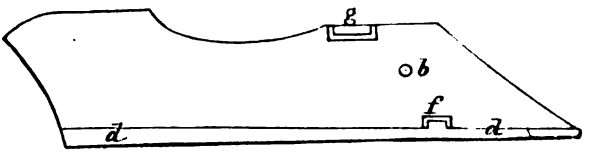

Fig. 69, e.

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a guide line. The lines *v p* and *v u*, both being in the surface of the board, the one where the furrow slice is nearly horizontal, and the other where it is perpendicular, the point, *v*, Fig. 69, I take as a radiating point to *u b' c' p*. A straight edge is to lie in each of these radiating lines so as to fit the actual mould-board.

"The same figure also exhibits another series of lines which lie in the surface of the board. These are parallel to the forward part of the base, *u s*, of the board, and touch the curve, *u b c p*, and the perpendicular, *o p*. They are also fitted by a straight edge. The angle formed by the base of the land side and the line *u s* is about 37½ degrees. The triangular space, *a' s m*, represents the heel of the mould-board, which is so formed as to cause it to lift or carry up the furrow slice to the top of that of the forward plow, which is from three to three and a half inches The form of this part is shown in Fig. 69, *b i s*, which is an end view of the heel, looking at it from the rear end of the plow. The line *a s* is formed by the termination of the curving out of the mould-board as seen at *a'*, Fig. 69, *b i s;* the part *a'* in the same figure being a vertical continuation of the body of the mould-board down to the sole, by which particular form this part is removed entirely out of the way of the furrow slice of the forward plow. The slice cut off by the fore plow may be about two and a half or three inches in thickness, and it is turned over by it into the furrow last made.

"Fig. 9 is a left-hand view of the mould-board of the forward plow, separate from the share and land side. E, Fig. 12 is the share seen in place in Figs. 16 and 17.

"Fig. 14 is the plan of the length and width of this plow corresponding to Fig. 68 of the hind plow.

"Fig. 15 is a right-hand view of the mould-board, share and coulter as combined for use.

"It will be seen on inspection that the curve of the mould board forms an irregular conical figure, the larger end being directed forward."

In October, 1839, Samuel Witherow, of Gettysburg, and David Pierce, of Philadelphia, took out a patent which was truly novel. We have not been able to ascertain that it ever got into general use, but it certainly seems worthy of a thorough trial. The following extract from the specification will show the principle upon which it was founded very clearly:

"It is a principle resting upon mathematical demonstration that

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a cycloidal arc is that which offers the least resistance to a descending body, and it is hence deducible that an ascending body will pass up a cycloidal curve with less resistance than up any other."

This may be true, but we have never seen any such demonstration. It is undoubtedly true that a body will fall through a cycloidal arc in less time than any other.

"The construction of our mould-boards is dependent on this principle. In forming them we employ the cycloidal curve in two ways, namely, to the formation of the concave of the mould-board in the lines of ascent of the sward or furrow slice in the act of plowing. The second application of the cycloidal curve is in the convex curve along the sole of the plow, constituting the part which enters and cuts the ground horizontally. In the accompanying drawing, Fig. 70 represents a mould-board, A being its point and B its heel; the line A B is that of the sole constituting the lower edge which cuts the furrow slice horizontally. This curve in a plow which has been essayed, and has been found to answer well, was generated by a circle of eighteen inches in diameter.

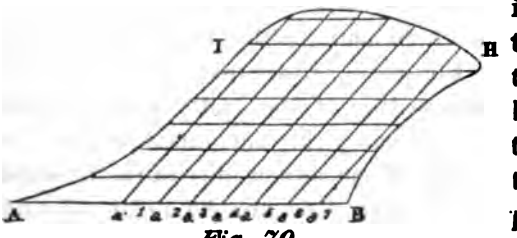

Fig. 70.

"In Fig. 71 the curve C D E may represent the cycloid generated by the circle F. The point D, which is that of least curvature, corresponds with the point A of the plow Fig. 70, the cycloidal line continuing to the hind part or heel at B. It will, no doubt, be advantageous to vary the curve according to the nature of the soil—a point to be determined by experience—but whatever variation may be found useful in this respect is still to be made in conformity with the principle upon which we proceed, namely, that of making it cycloidal. The line I H along the upper part of the mould-board and in a plane parallel to that of the plane of the line A B, we also make to fit the same cycloidal gauge.

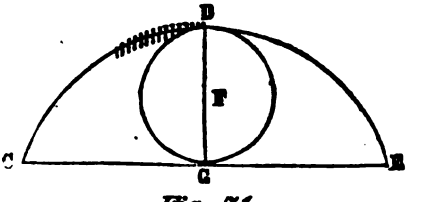

Fig. 71.

"In the plow that has been put in operation with a view of testing

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the principle, the lines of the ascent of the furrow slice which govern the concavity of the mould-board, were regulated by a cycloidal gauge made to a curve generated by a circle of sixteen inches in diameter. Let C D G, Fig. 71, represent such a gauge, and the lines a^2 a^3, &c., Fig. 70, be assumed as those of the ascent of the furrow slice on the mould-board; in forming said board we place the gauge in the direction a' with the part D, which is that of least curvature at a', and thus proceed on until we arrive at the hinder part, B H, withdrawing or lowering the gauge at its lower end at each successive application, so that a small portion of the least curved portion towards D, and a larger portion of that towards C shall touch the mould-board; these successive depressions may be indicated by the divisions at D upon the gauge. The degree in which the mould-board shall curve and hang over at H for turning the furrow slice may be varied according to the judgment of the maker, the curvature being governed by the diameter of the generating circle and the degree in which the gauge is depressed at every successive application of it.

"Having thus fully set forth the nature of our invention, and shown the manner in which we carry the same into operation, what we claim therein is the giving to our mould-board the segment of a cycloid convexly on its face in a line leading from front to rear, and concavely in the lines of the ascent of the furrow slice."

REMARKS BY THE INVENTORS.

"The main object is to pulverize the soil"—(they are the first who have made this avowal among inventors)—"and the only way in which this can be effected is by bending a furrow slice on a curved surface"—(this is the first allusion that we have met with to the influence of the shape of the surface in cracking the soil)—"so formed that it shall also twist it somewhat in the manner of the screw. Such a surface will be formed by taking a strip of iron and twisting it after the manner of a screw auger; and if there is given to this piece of iron a greater twist at one end than the other, cycloidal curves may be thereby produced. Now as the curvature of the cycloidal mould-board generally increases from the lowest to the highest point of ascent, it follows, necessarily, that the furrow slice, in passing along it, will be more and more bent as it ascends. By forming the fore part of the mould-board by means of that point of the cycloidal gauge which has the least curvature and the hinder part by that portion which has

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the greatest, the bending of the furrow will continue and be increased as it passes horizontally as well as in its ascent. By forming the lines of ascent cycloidal concavely and the horizontal lines cycloidal convexly, the twist in the mould-board will gradually increase from the fore to the hinder part as the curves contract, which will operate very advantageously in pulverizing the soil. The convex cycloidal form given to the horizontal lines will cause the furrow slice to leave the mould-board in a direction well calculated to prevent it from falling off in segments. The advantages possessed by this mould-board, as has been abundantly proved in practice, are, that it will seem light, and that it will turn the furrow slice over in a connected sheet well pulverized."

It has always been an object with inventors to diminish the friction of the land side. The first earnest attempt to realize this idea in practice was by T. D. Burrall, of Geneva, who claimed, on the 28th of October, 1843, as follows:

"The nature of the invention consists in removing the sole of the land side, and placing an inclined wheel, denominated a shell wheel, between the land side and the mould-board, with its face in a line with the cut of the coulter. The land side curves up from the point of the share and backward to the junction of the handle and beam. The beam is halved on the land side outward and the handle is affixed to the side of it, the whole being secured by a screw bolt passing through them. This forms a secure joint, without tenon and mortise, without materially weakening the beam or handles. This plow was carefully tested by the New York State Agricultural Society. At first it ran easier than the plows that were tried in competition with it, but after a little while it became choked, and then its draft was greater than the others. The judges of the society did not consider it an improvement, and we believe the public have pretty fully ratified their decision."

In the year 1839, Cyrus Alger, of Boston, received a patent for annealing cast iron plows, by which they were rendered malleable, so that the shape could be altered when desired, and then hardened and tempered like steel. We are not informed whether this patent was ever brought into practical use, or whether it answered, in any tolerable degree, the purposes for which it was designed. If it really accomplished what it proposed to do, it would, in our judgment, be very important.

The next attempt at a mathematical mould-board was made by Mr. Samuel A. Knox, of Worcester, for many years the foreman

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Mould = Boards of Planes.

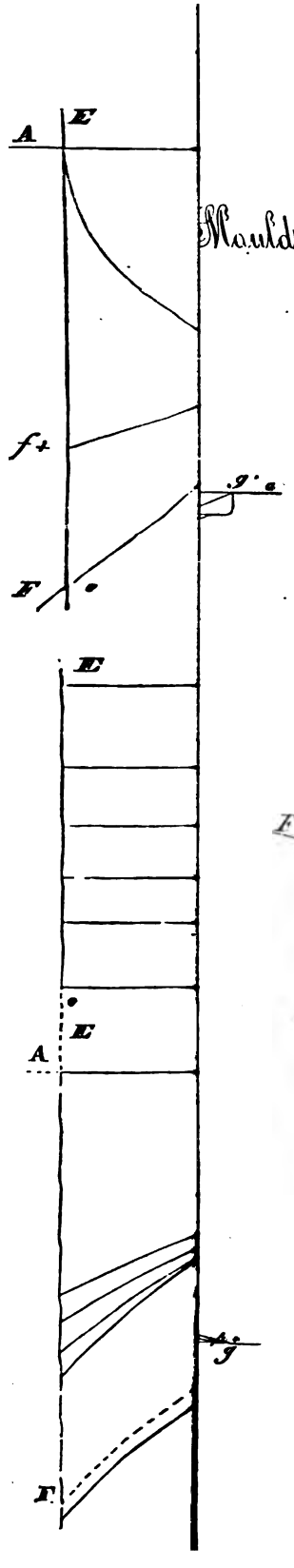


Fig. 6.

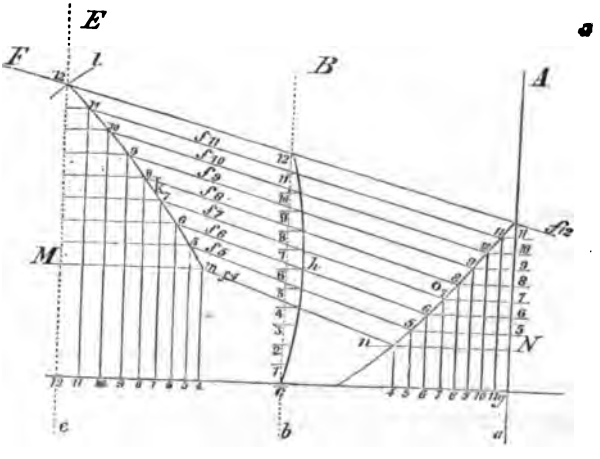


Fig. 8.

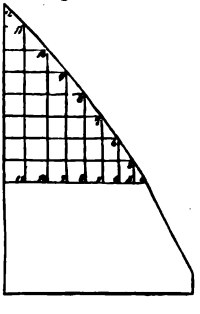
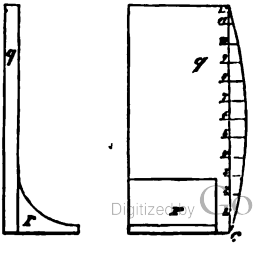


Fig. 7.



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of Messrs. Ruggles, Nourse & Mason. It is strictly geometrical in its construction, and it probably works with as little resistance as any plow that was ever made. It turns over the furrow very handsomely as well as evenly, and would secure the unlimited approbation of an English plowman; but its pulverizing power is somewhat deficient. and it therefore fails in what we consider one of the most important functions of a plow. A view of all the lines is given in Plate VIII. The patent for this method was granted in 1852.

KNOX'S SPECIFICATION.

"To enable any one skilled in the art of plow-making to form the mould-board of plows, according to my said invention, I will first describe the mode of determining the form of the surface of a pattern from which to mould and cast the mould-board of a green-sward, flat-furrow plow intended for a twelve-inch furrow; and I will then indicate the changes necessary to the production of the required form for an old-ground plow, from which any skillful plowmaker will be enabled to make the necessary changes for plows of any other dimensions.

"For making the pattern from which to cast the mould-board of a green-sward, flat-furrow plow, I first determine the proportions of the base by drawing a line, *A a*, diagram Fig. 1, which represents the line of the land side, and at right angles to this I draw another line, *B b*, on which I determine the breadth of the base of the plow from the line of the land side to the heel, *c*, of the mould-board, say twelve inches for a furrow of that breadth, and this I divide into inches. I then draw two lines, *D d* and *E e*, parallel with, and one on each side of, and at a distance of twelve inches from, the line *B b*. I then draw a diagonal line, *F f*, from the intersection of the line *D d* and *A a*, passing through the line *B b* at *c* (the heel of the intended mould-board), and project the said line until it intersects the line *E e* at *e*, and the plane of this line, *F f*, perpendicular to the base, at the required height, to be hereafter specified, determines the inclination of the upper edge of the working surface of the intended mould-board to the vertical plane of the line *A a* or land side. The distance of the point of the plow at *g*, from the line *B b*, is determined by multiplying the length of the diagonal line, *F f*, in inches, from the point where it intersects the lines *A a* and *D d* to the point of its intersection with the line *B b*, by an equal number of inches, and then dividing this product by the

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breadth of the intended plow at the heel, *c*, of the mould-board, say twelve inches, the product of which will be twenty-four inches and one twelfth ($24\frac{1}{12}$), and add to this product one-tenth thereof, which will make the distance of the point from the line *B b* twenty-six inches and fifty-nine one hundred and twentieths ($\frac{59}{120}$).

"Having determined the above proportions, I build up a block, represented at Figs. 2 and 3, from which to form the pattern, and consisting of a series of flat blocks of wood, glued together to the required height in the usual manner of preparing blocks for making plow patterns.

"The face, *A a*, of the said block is made perpendicular to the base and corresponds to the line *A a* or land side of diagram Fig. 1; the end, *E e*, presents a plane perpendicular to the base and at right angles to the face, *A a*, and corresponding with the line *E e*, of diagram Fig. 1, and the opposite end at *g* is cut to the required length for the location of the point of the plow. On the under side or face of this block I transfer the two lines *B b* and *D d* and the diagonal line *F f* from diagram Fig. 1, as represented in the dotted lines, Fig. 3. And I also mark on the face, *A a*, and also on the opposite face of the said black lines, *B b* and *D d* to represent the planes of the said lines perpendicular to the base, as represented by dotted lines in Fig. 2.

"I divide the block into three imaginary divisions by three imaginary planes perpendicular to the base, and corresponding with the three lines *B b*, *D d* and *E e*, the first division being at the line *D d*, the second at the line *B b*, and passing through the heel of the intended mould-board, and the third at the line *E e*; I then draw a diagram, Fig. 6, with a base line representing the base of the plow on which I erect a perpendicular line, *A; a* representing the land side or line *A a*, diagram Fig. 1, and parallel therewith, and at a distance therefrom of equal to the breadth of the plow from the heel of the mould-board, in this case twelve inches, draw line *B* corresponding with the line *B b* on diagram Fig. 1, and from the base mark on the said line twelve divisions of one inch each, numbered from one to twelve. And I then strike the arc of a circle, *h*, on a radius of double the breadth of the intended plow at the heel of the mould-board, which in this case will be twenty-four inches, the said arc being made to intersect the line *B b* at the base and at the twelfth division from the base; and then draw lines parallel with the base through each of the points of the twelve divisions to intersect or cut the said arc,

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the said lines being indicated by the figures numbering the several divisions on the line *B b*. The arc *h* represents the concavity of the face of the intended mould-board at the second imaginary division. And the point of intersection of the said arc *h* with the base in the position of the heel of the mould-board and marked *c*, and the point of its intersection with the division line 12 determines the height of the line *F f* of the upper edge of the working surface of the mould-board and perpendicularly over the heel of the mould-board.

"On the said diagram Fig. 6, I draw another line, *E e*, parallel with the line *B b*, and at a distance therefrom equal to the breadth of the plow at the heel of the mould-board, and in this case twelve inches. I then draw a straight line, $g f^4$, from the point of intersection of the line *A a* with the base to the point of intersection of the division line 4 with the arc *h*, and project it beyond the arc *h*. But it becomes necessary to determine the height, from the base, at which this line $g f^4$ will intersect the plane of the third division. This I obtain on Fig. 5, which represents the lines on the face of the mould-board when projected on a plane perpendicular to the base. On this figure I draw the three parallel lines *D d*, *B b*, *E e* perpendicular to the base, and, as in the other figures, indicating the first, second and third divisions, as also the distance of the point *g* of the plow from the second division. I transfer on the line *B b* of this Fig. 5, from diagram Fig. 6, the several divisions numbered from one to twelve of the arc *h* of Fig. 6, and I then draw a straight line from the point *g* through the division numbered 4 and project it to the line *E e*, or plane of the third division, and this gives the inclination of the line $g f^4$ to the base, and hence the height of its intersection with the plane of the third division. And this height from the base I transfer to diagram Fig. 6, and draw through it a line *M m* parallel with the base until it intersects the line $g f^4$ on this diagram Fig. 6, and from this point of intersection I describe the arc of a cirle *l* on a radius equal to the breadth of the plow at the heel of the mould-board, in this case twelve inches; I then describe an arc of a circle, *k*, of a radius of four times the breadth of the plow at the heel of the mould-board, and in this case forty-eight inches, making the said arc pass through the points of intersection of the arc *l* with the line *E e*, and the line $g f^4$ with the line *M m*. This arc of a circle, *k*, determines the concavity of the face of the mould-board at the plane of the third division,

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and the point of its intersection with the line $E\ e$ determines the height of the upper edge of the working surface of the mould-board from the base. And having thus obtained this height I transfer it on to the line $E\ e$, Fig. 5, and from this height I draw the diagonal line $F f^{12}$ intersecting the division 12 on the line $B\ b$ twelve inches from the base, and project it to the front end of the plow. The inclination of this line to the base line gives the inclination of the upper edge of the working surface to the base of the plow, its inclination to the plane of the land side having been determined by the line $F f$ on diagram Fig. 1. The inclination of the line $g\ f^4$ to the plane of the base has already been determined, and to determine its inclination to the plane of the land side, I delineate on diagram Fig. 1 the arc h of Fig. 6, so that the chord of the arc shall be parallel with the line $A\ a$, and intersecting the line $B\ b$ at the point c, or heel of the mould-board, and so that the line of division 4 shall coincide with the line $B\ b$, the convexity of the arc being towards the line $A\ a$, I then draw the diagonal line $g\ f^4$ from the point g of the plow to the line $E\ e$, or third division, and intersecting the line $B\ b$ at the point of its intersection with the arc h. The inclination of this line, $g\ f^4$, to the plane of the land side, so determined on diagram Fig. 1, I transfer to Fig. 4, which represents a plan view of the mould-board, with the lines projected on a horizontal plane, where it indicates the inclination of that part of the surface of the mould-board to the plane of the land side, along the entire length of the mould-board, the inclination thereof to the base having already been defined and represented in Fig. 5.

"Having, in the manner above described, defined and located the inclination of the surface of the mould-board to the plane of the base and the plane of the land side, along the straight line $F f^{12}$ or upper edge of the working surface, and along the straight edge, $g\ f^4$, from the point of the plow to the third division, it becomes necessary to define the form at certain distances between these two lines sufficiently near to each other that the workman may practically work down the whole surface of the mould-board. I have found that by lifting the form on the lines at distances of about an inch apart, that the workman can finish the residue of the surface with sufficient accuracy for all practical purposes; but, after the location of certain lines at this distance apart, by the same rules these divisions can be multiplied to an indefinite extent.

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"Referring to diagram Fig. 6, the diagonal lines $F f^{12}$ and $g f^4$ will be found. On the line $E e$ I divide the space between the points of its intersection with the arc, k, and the line $M m$ into eight equal parts, and from each of the points of division I draw lines parallel with the base to intersect the arc, k, and these points of intersection I mark from 4 to 12, as the divisions are marked on the arc, h, of the second division; and I then draw diagonal lines, f^5, f^6, f^7, f^8, f^9, f^{10}, f^{11}, passing through points of the divisions correspondingly numbered on the arc, h, of the second division, and on the arc, k, of the third division, and project them until they intersect the first division. On Fig. 5, I measure the height from the base where the line $F f^{12}$ intersects the line $D d$ or plane of the first division, and transfer that distance or height on the line $A a$ or plane of the land side. In like manner, on Fig. 5, I measure the distance or height from the base where the line $g f^4$ intersects the line $D d$ or plane of the first division, and transfer that height on to the line $A a$, of Fig. 6, from the base, and draw a line, $N n$, parallel with the base until the said line intersects the diagonal line, $g f^4$, and this point of intersection will be found to be at the same distance from the line $A a$, Fig. 1, as the point of its intersection of the said line $g f^4$ with the line $D d$ or plane of the first division is distant from the plane of the land side, so that these several points of intersection on these several figures prove each other. I then strike an arc, o, of the same radius as the arc k (forty-eight inches), so that it shall intersect the point where the line $F f^{12}$ intersects the line $A a$, and also the point where the line $N n$ intersects the diagonal line $g f^4$; and the distance between the lines $F f^{12}$ and $N n$, where these lines cut the said line $A a$, I divide into eight equal parts, and from these divisions I draw lines parallel with the base, and these several lines will be found to cut the several diagonal lines, f^5 to f^{11}, inclusive, where they intersect the arc o, which points of intersection on the said arc, o, are numbered from 5 to 11, as the corresponding divisions are marked on the arcs, h and k, of the second and third divisions.

"From the several points of intersection on the said arcs o and k of the first and third divisions, numbered from 4 to 12 inclusive, I draw lines perpendicular to the base, and cutting the said base lines; and the divisions thus obtained on the base line of Fig. 6 I then transfer to Fig. 4, transferring the divisions obtained from the arc o on to the line $D d$, or first division, and beginning with . .

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number 4, which will be found to coincide with the diagonal line $g f^4$ and ending with number 12, which in both figures is the point of intersection of the diagonal line $F f^{12}$ with the line $A a$ or plane of the land side. And the divisions obtained from the arc k or third division, in like manner transfer to the line $E e$, or third division, on Fig. 4, measuring on both figures from the lines $A a$, or plane of the land side, and the division number 4 will be found to coincide with the diagonal $g f^4$, and the division number 12 with the diagonal line $F f^{12}$ or upper edge of the working surface of the mould-board. From the several points of division thus transferred on the lines $D d$ and $E e$ of Fig. 4, except the two numbered 4 and 12, on which the lines $F f^{12}$ and $g f^4$ were previously drawn, I draw straight lines diagonal to the plane of the land side, which lines are marked $F f^5$ to 11 inclusive. And where these several lines cut the lines $B b$, or plane of the second division, the distance of each from the line $A a$, or plane of the land side, will be found, on measurement, to be equal to the distance of the correspondingly numbered divisions on the arc h of the second division from the line $A a$ on diagram Fig. 6. In this way the inclination which the surface of the mould-board makes to the plane of the land side along the several lines $g f^4$ to $F f^{12}$ is obtained, defined and proved, and it only remains to obtain, define and prove the inclination of the said surface to the base of the plow along the said lines. This is done by transferring the divisions on the arcs o and k, as projected by lines parallel with the base, to the lines $A a$ and $E e$. Those on the line $A a$ of Fig. 6, I transfer to the line $D d$ of Fig. 5, measuring both figures from the base; and those on line $E e$ of Fig. 6 to the corresponding line $E e$ of Fig. 5, measuring both figures from the base. The surface of the mould-board having been defined at the first, second and third divisions, and along the several inclined lines from $g f^4$ to $F f^{12}$, the workman will be enabled to make the surface between conform properly to the surface at these lines; but it will be obvious that the number of graduations on the arc h of the second division, instead of being made one inch apart, which I have found to be sufficient in practice, may be made as much less than an inch as the constructor may desire. As the form below the line $g f^4$ runs into the cutting edge of the share it is left to the judgment of the constructor to determine the form of that part, as also the form or extent of the surface above the line of the upper working edge of the mould-board and the

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extent of the wing back of the second division, as it may be cut short of, or extended back of the third division; as also with the amount to be cut away along the lower edge of the wing back of the heel of the mould-board.

"The drawings represent that form of the auxiliary parts which I prefer, but to which I do not wish to be understood as confining myself. The points where the several lines $g\ f^4$ to $F\ f^{12}$ intersect the vertical plane of the land side, and marked p^4 to p^{12}, in Fig. 5, will give the general configuration of the line of the forward cutting-edge, termed the shin of the plow. The mode of procedure which I have adopted for working out the block of wood to the form required for making a pattern is as follows: I make an instrument or gauge, Fig. 7, consisting of a plate, *q*, on a base, *r*, at right angles therewith, and one edge of the plate, *q*, is cut to a form fitting the concavity of the arc, *h*, Fig. 6, when the base, *r*, of the said instrument is in the plane of the base of the said Fig. 6, and hence this curved edge will be the proper gauge to determine when the face of the block, Figs. 2 and 3, is cut to the required concavity in the plane of the second division. I transfer on the face of the plate, *q*, of the said gauge up to the curved edge thereof, the graduations or divisions of the arc, *h*, Fig. 6. When the plane of the said gauge is in the plane of the second division, *B b*, and the plane of its base in the plane of the base of the block and the angle, *c*, at twelve inches from the face, *A a*, of the said block, or vertical plane of the land side, then the workman has obtained the required concavity of the face of the block in the plane of the second division, and marks thereon the divisions on the face of the gauge to locate the several divisions, numbered from 1 to 12, of Fig. 6. I then make another gauge, Fig. 8, in like manner, with the curved edge thereof fitted to the concavity of the arc *k*, Fig. 6. While the base of the gauge is in the plane of the base of Fig. 6, and on the face of this gauge, I transfer the graduations of the arc *k*. I then cut into the face of the block, in the direction of the plane of the third division, until the curved edge of the said gauge touches every part of the said surface, and its vertical edge, *E e*, is at the same distance from the plane of the block which represents the land side, as the line *E e*, Fig. 6, is from the line *A a*, of the said figure, and the base of the gauge is in the plane of the base of the block. This determines the requisite concavity of the block in the plane of the third division, and at the required distance from the land

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side, and I then transfer on the surface of the block the graduations on the edge of the gauge, numbered from 4 to 12.

"I then make a third gauge, Fig. 9, in like manner as the other two, to correspond in every respect with the arc *o*, Fig. 6, as the other gauges were made to correspond with the arcs *h* and *k*. I cut and mark the surface of the block on the plane of the first division in the same manner as it was cut and marked by the other gauges in the plane of the second and third divisions, and bearing the same relation to the face of the block which represents the land side that the arc *o*, on Fig. 6, bears to the line *A a* or plane of the land side. Having thus cut away the surface of the block to the required concavity in the plane of the first, second and third divisions, and marked and numbered thereon the several graduations to correspond with the graduations on the arcs *o*, *h* and *k*, of Fig. 6, I then cut away the surface of the block in the direction of straight lines, so that a straight edge will touch along the entire length of the surface, passing through the graduations correspondingly numbered on the concavity at the three divisions, as shown on Figs. 4 and 5 by the lines $g f^4$ $F f^6$ to $F f^{12}$, inclusive, and then work off the remaining portions of the surface between and beyond these lines to a form which will correspond therewith."

Plows had previously been made approaching in some degree to a cylindrical form, but Mr. Joshua Gibbs, on the 15th of August, 1854, patented a plow which strictly conformed to this principle, as will be seen by the following extracts from his specification:

"Fig. 72 is an elevation of my improved plow, showing the working side of the mould-board. Fig. — is the representation of the interior of a cylinder from which the mould-board was made. Fig. — is a section of said cylinder. Fig. —, the mould-board as seen when looking at the forward end. Fig. —, the land side and parts connected with it. * * * *

"The working surface of the mould-board, A, consists of about one-quarter of the interior surface of a hollow cylinder, one end of which is represented in Fig. —, and a section of the interior in Fig. —. If the plow is intended to turn a furrow six inches wide, a mould-board made from a cylinder of about twelve inches bore is desirable; but if it is to turn a furrow twelve inches wide, the mould-board should be made from a cylinder with a bore of about two feet. As these plows have been found to work

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best when the length of the mould-board is from once and a half to twice the diameter of the bore of the cylinder from which the mould-board is made, and the form of its exterior edges about the same as represented in the drawing, the mould-board may be fastened to the other parts of the plow as may be convenient or desirable, taking into consideration the material from which it is made. The share is fitted to the lower edge of the mould-board, and its point is fitted to a recess in the heel of the coulter, C.

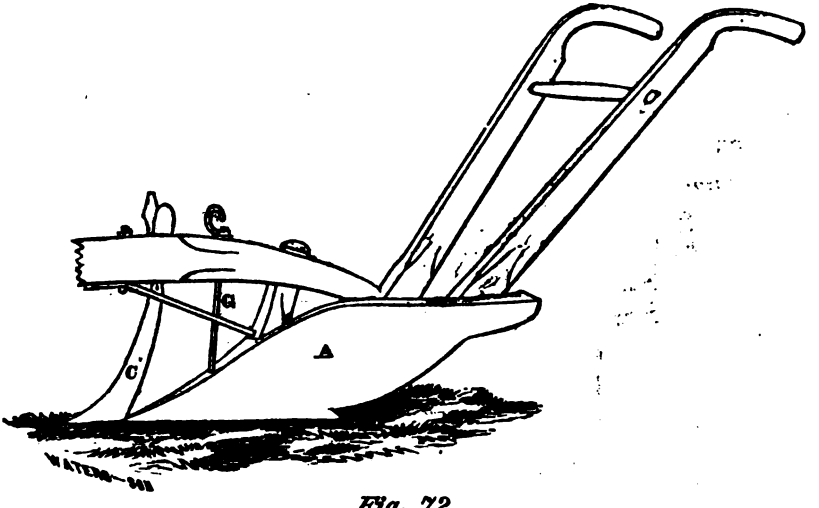

Fig. 72.

"It has been found that when the top of the land side was made parallel with the bottom, and a wooden standard fitted to it, with a shoulder fitted against the top edge of the land side, that the shoulder upon the wooden standard is soon worn off as the wood wears away, so as to leave the plow defective and liable to get loose and shackling.

"To remedy this defect, and improve the plow in this respect, I make the top of the land side, D, opposite to the wooden standard, E, at an angle about as represented in the drawing, that is, higher towards the forward end of the plow, so that the iron land side shall protect the shoulder of the wooden standard, E, and prevent it from being worn off, so as to preserve a shoulder upon the standard, E, as long as there is any of the iron of the angle, F, remains upon the land side to press against it, when the false coulter, or bolt, G, is screwed up to hold the parts together." Claim—"making the working surface of the mould-board in the form of a hollow cylinder; the centre or axis of said cylinder

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being parallel or nearly parallel horizontally to the base of the mould-board or bottom of the plow substantially as described."

In 1858, H. M. Platt invented a plow which was literally a screw-auger. It had wings, and a pair of broad wheels which turned an axis on which a mitre wheel was keyed, which played in a pinion upon the shaft of the auger, which drew the slice backward on to the wings, which rolled it over into position. We believe this has not been successful in practice.

M. L. Roberts, of Smithville, Canada West, has no land side, but in place of it a wheel whose plane is at an angle of 45 degrees, and the mould-board consists of vertical rollers, the object of which is to diminish the friction of plowing.

Chapman & Barnum have also patented a device for diminishing the friction of the land side, which consists in substituting for the ordinary rear wing of the mould-board a revolving body what would be called a cone if its sides were bounded by straight lines. The sections, made vertically through the axis, are arcs of circles. The small end of the cone is directed downward and the larger one upward. The lower end of the axis is inserted into a prolongation of the shoe, backward, the upper one being inserted in a bar, movable laterally, so as to increase or diminish the angle of the axis, at pleasure, with the plane of the sole.

We have not tried any of these friction expedients, but, from the best information we can obtain, they are illusory, and have never, so far, been practically successful.

In September, 1863, Mr. Mead, of New Haven, obtained a patent for a plow, the share and mould-board of which conform exactly to the surface of a frustum of a cone, as shown in Fig. 73.

We have now passed in review all the expedients which have been devised within the period of four thousand years for the improvement of the plow. We do not flatter ourselves that we have seized on all the successive steps which have been made in the construction of this most important implement. If any attempt has been made to write a connected history of the plow before us, we have not been able to find it. We have traveled through a field hitherto unexplored, and it would indeed be wonderful if we should not miss some of the objects lying in our way.

It will be seen that the first idea of the plow was a crooked stick, of which various forms were in use. Then came the provision of an iron point to the plow. Up to this time the crooked

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sticks used were on the principle of the double mould-board; they threw off the earth on each side. The next step was to hew off one side of the stick, so as to throw out the earth only on one side, approximating to a single mould-board. Then the plow became a simple wedge, the land side being nearly parallel with the line of the plow's motion, the other moving the furrow slice to the right, but leaving the furrow standing on edge. Then the wedge was gradually twisted so as regularly to invert the furrow. Jefferson and Small discovered the importance of straight lines running from the sole to the top of the share and mould-board.

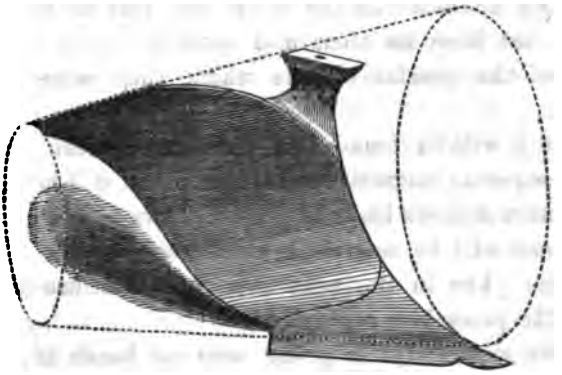

Fig. 73.

Colonel Pickering was the first to discover the importance of a straight line running from the front to the rear. Jethro Wood discovered that all the lines running from front to rear should be straight. Mr. Knox first discovered a method of laying down all the lines of a plow on a plane surface. Mr. John Mears was the first to discover the importance of centre draft, and pointed out the practical means of attaining it by the inclination of the land side inward.

Aaron Smith was the first to adopt two plows to work well together, one of which threw two or three inches of the surface into the bottom of the preceding furrow, and the other covered it with the lower earth.

Finally, Governor Holbrook has invented a method by which plows of any size may be made symmetrically, either convex or concave, in such a way as to insure the complete pulverization of the soil.

We believe that we have been the first to announce that the great object in all plows is to form the curve in such a way as to make all the parts of the furrow slice to travel with different

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velocities in order to produce pulverization, but that these different velocities should be no greater than is required for the disintegration of the soil, in order to avoid an unnecessary expenditure of power.

In view of the fact that the plow has always been regarded as the basis of all civilization and all wealth, it may well excite astonishment that it should have required so many years to have made the few successive advances which we have just detailed.

We can only account for the apparent anomaly by remembering that very few of the gifted minds of successive generations have devoted their attention to the plow, and that until the present time there has been no clear and definite idea in the minds of inventors of the precise objects which they were seeking to accomplish.

We hope it will be found that the very careful and accurate trials with superior instruments made at Utica, will have the effect of giving more definite ideas to the inventors of the country, and that the result will be seen in a more rapid series of improvements in the plow in the next five years than has been accomplished in the preceding centuries.

Just as the manuscript is going into the hands of the printer we have received a pamphlet giving a description of Dr. Grant's new invention of a plow for deep tillage.

We are heartily in sympathy with the objects which the Doctor has in view, but as we have never seen the plow nor its work we can give no intelligent opinion of our own as to his success in practically accomplishing those objects.

We give the drawings and description from the pamphlet as a part of the current history of the plow.

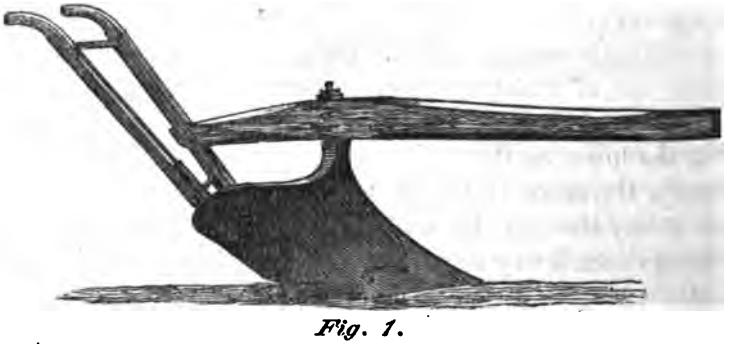

Fig. 1.

Fig. 1 represents the Iona turning plow, which has been fitted for receiving certain additions by which it is transformed to an

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implement of entirely new character, and rendered capable of very desirable preparation of the ground by deep working. The additions are very readily applied when the transformation is required, and as easily laid aside again when it is wanted for ordinary work without impairing in any degree its utility or convenience.

Fig. 2 represents the most important of the additions for the transformation to which all of the others are accessory or supplemental. This consists chiefly of an inclined plane or share, either in one or more pieces, as circumstances may determine. This arrangement has a corresponding land side, to which the original gives place in transformation. There are two sizes of the inclined plane, designated as No. 1 and No. 2. The latter is able to raise its slice of subsoil from the greater depth. Each size of the inclined planes has a corresponding accessory part for rendering them more efficient for certain purposes that will be noted in the account of the operation of the implement. There are also two supplementary pieces for increasing the width of the mould-board at its upper edge, the wider of which is used for the deeper working.

Fig. 2.

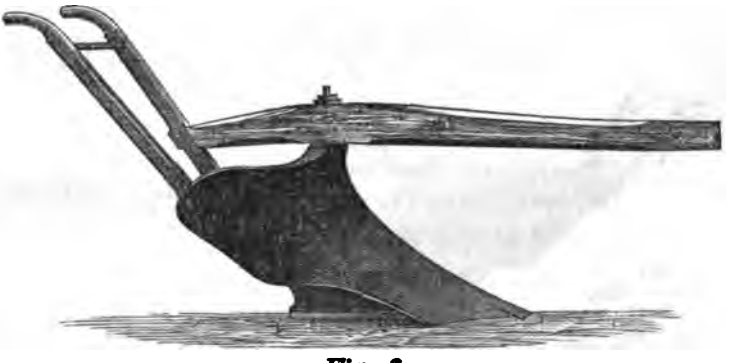

Fig. 3.

Fig. 3 represents the most simple form of the Transformed No. 1, having the narrow supplemental plate and the No. 1 inclined plane without any of the accessories, all of which are important in fitting it for the variety of uses to which it is adapted. These are of the utmost simplicity in their manner of application, are durable in wear, and not liable to break or get out of repair. These plows perform easily and thoroughly the operation of trench plowing, that is often attempted but always with a very

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small measure of success) by driving large plows of the ordinary construction twice in the same furrow. The inclined plane performs thoroughly the work of a shovel or spade, and much more, taking up the subsoil cleanly from the bottom, leaving a level floor, finely pulverizing and mingling it with the fertile soil, but placing more of the surface soil at and towards the bottom than toward the top, or *vice versa*, as may be desired, mingling manure also most intimately throughout, when that is used.

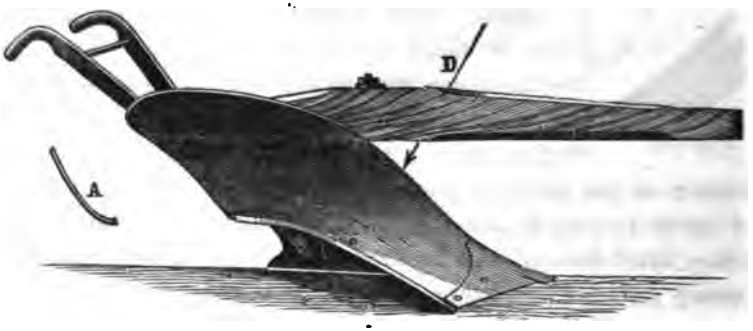

Fig. 4.

Fig. 4 represents Great Trench Plow No. 1. It cuts a furrow ten inches wide, and has good turning power for any thickness of slice not exceeding ten inches, and is calculated for any depth not greater than twenty inches. It is designed for heavy soils.

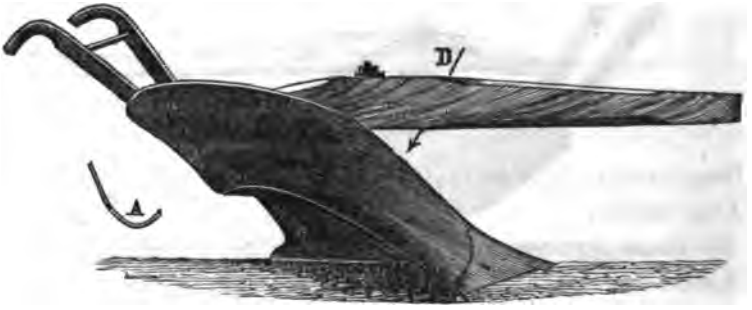

Fig. 5.

Fig. 5 represents Great Trench Plow No. 2, which is designed for moderately adhesive loams, and for very friable sandy and gravelly soils, and will do the work well two feet deep, or any less that may be required.

Fig. 6 represents a great Trenching Plow that is constructed for working in loams or clays, but is prepared for the reception of appliances that adapt it for light loams or the most crumbly

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gravels. Its gauge is for less depth than the preceding, but by the assistance of the appliances it may be fitted for a depth of twenty inches or more.

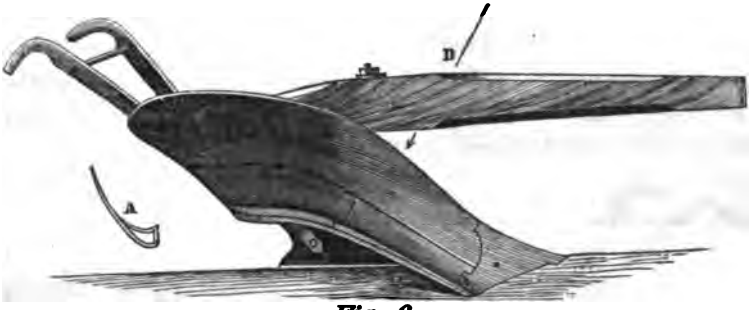

Fig. 6.

Fig. 7 represents a larger plow of the same plan as the preceding, that by such accessions as are represented in the cut can be regulated for any kind of practicable soil and for any depth between sixteen and twenty-four inches.

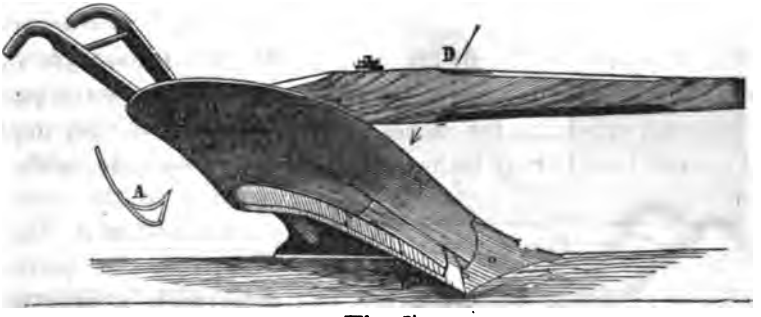

Fig. 7.

Deep working may be divided into two kinds that are effectual, and one ineffectual. The two effectual kinds may be designated by the terms *half-trenching* and *trenching*, or, for marked distinction, *thorough-trenching*. The former is often preparatory to the latter. Ineffectual deep-working is when tillage plows, going deeper than their turning gauge, simply raise the soil to let it fall back as if nearly undisturbed. Trenching (or thorough-trenching) consists in reversing the two strata, that is, putting the upper fertile portion below, and lower unfertile portion above, the thickness of the latter being determined by the depth of working. For convenience, we designate these strata by the terms *soil* and *subsoil*, as well as by the descriptive terms *fertile portion* and

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infertile portion, using them interchangeably, as may seem most convenient or applicable.

When pretty deep trenching is to be done, the labor of opening the first trench is considerably greater than that required for the succeeding ones, whether performed with spade or plow, but particularly so with the latter. Fig. 1 represents a trench about nine inches deep, through which the turning and trench plows have each passed, and the raising capacity of the latter is nearly exhausted by the bank. By strenuous effort, six inches more of depth might be accomplished, but not very satisfactorily. To enable the plow to gain nearly the requisite depth in this first trench, the bank, A, must be removed to the position represented at A, Fig. 2. This may be partially done with a plow, but must be completed with spades or shovels, when the depth represented by *p*, Fig. 3, may be easily gained, but it will be difficult to go deeper in the trench with any of the plows here represented. The next proceeding in order is to turn over and throw down into the trench, *p*, a slice composed of the thickness of

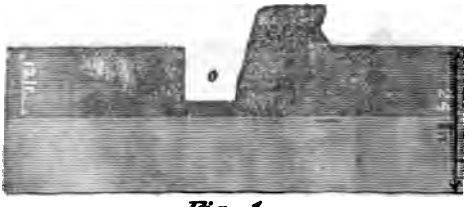

Fig. 1.

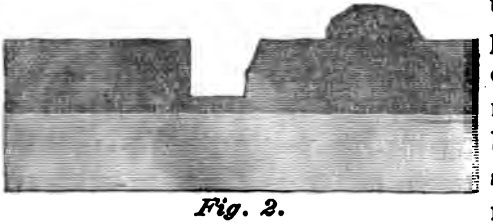

Fig. 2.

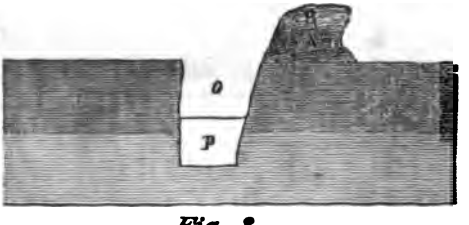

Fig. 3.

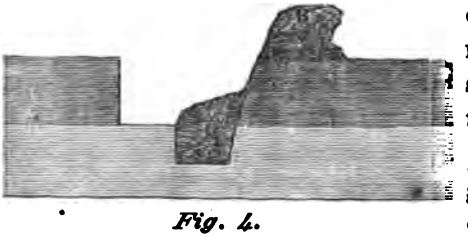

Fig. 4.

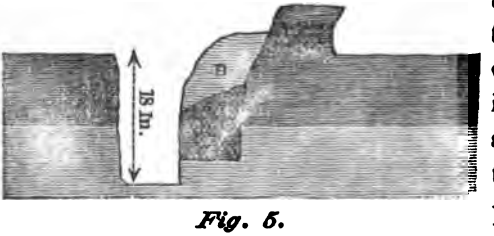

Fig. 5.

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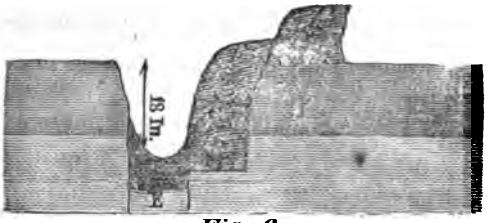

Fig. 6.

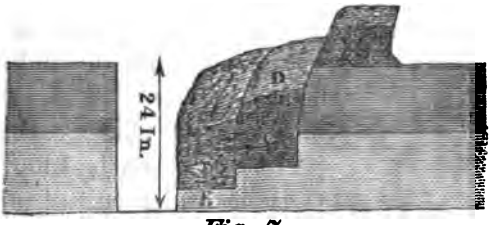

Fig. 7.

the fertile stracum, and as wide as the trench, as represented at C. The next step is to raise a slice of the subsoil of any thickness required, not making greater depth than twenty-one inches, as shown at D. The dart marked eighteen inches, by error, should be 21. The representation in Fig. 5 is of work done in adhesive loam, and shows rather the working of the plow than the exact appearance of the trench, that never being quite so clear and square after the passage of the plow, as is here represented.

In very unadhesive, gravelly or sandy soils the appearance will be as represented in Fig. 6. Debris, as at H, occurs in gravels, consisting in part of the falling of the edge of the land side bank, and in part of the falling back of the subsoil slice. This is often in about the proportions required, and then only the passage of the transformed, with its peculiar grinding action is required to perfect the operation. If a larger admixture of the surface soil is required at the bottom of the trench, a small slice of it is easily thrown down by a small plow drawn by one horse before the passage of the transformed.

It is, of course, impossible to leave as clean a furrow as is represented in Fig. 7, as the ground from both sides will fall in and fill the furrow. It is rather intended to represent the actual working of the plow at the depth of two feet. These plows are worked with two pairs of strong oxen.

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CHAPTER VI.

ON THE OBJECTS TO BE ACCOMPLISHED BY PLOWING.

Before we can judge of the best form and arrangement of the plow, we must first clearly comprehend the objects sought to be accomplished by plowing land.

In general we may say that we seek in plowing land to cause it to yield a greater amount of crops; but this general answer is insufficient for our purpose. We want to know *why* plowing the land makes it more fertile before we are in a position to know which of the various forms of the plow is best adapted to promote the desired fertility.

If we find that two or more forms of the plow are *equally* adapted to improve the condition of the land, the question then arises, which of them can be worked with the greatest economy? This question involves several elements. We are to inquire which of them can be worked with the least expenditure of animal power. It has been proved by the trials instituted by our own Society, by the Highland Society of Scotland, and by the Royal Agricultural Society of England, that some forms of the plow can open a given sized furrow with thirty per cent less of power than others, or what is nearly the same thing, two horses will do as much as three. It is easy to understand that the farmer using the one will find farming a remunerative occupation, while the farmer that uses the other will carry on his business at a loss. Another question which must be answered under this head of inquiry is, which of the plows will wear the longest? It is well known that there are great differences in this respect, some lasting five times as long as others. The points of many plows now in market will only last for a single day. Again, some plows can be advantageously worked by much less skillful workmen than others, and, of course, unskilled laborers can always be obtained at a lower rate of compensation than the skilled classes. Finally, there are some plows which can be worked with far less labor by the operative, which is an advantage that no good farmer will overlook. The plow which combines with the lowest price the greatest number of these advantages is clearly to be taken as the cheapest plow.

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Let us first endeavor to understand how the plow makes land more fertile. To accomplish this we must know what fertility is, and what causes it.

All plants whatever have their origin in a minute germ whose weight is exceedingly small compared with the weight of the fully developed plant. The germ has no creative power whatever; it can only assimilate other matter with its own substance, and the whole of the extra weight of the mature plant consists of foreign matter which, by a curious but not unintelligible chemistry, the germ has assimilated with its own tissues and made a part of its own substance.

The substances thus assimilated are numerous, varying in different plants, but all derived originally from the rains and dews, from the atmosphere and the soil.

The compounds derived from air and water are called organic; those derived from the soil are called inorganic. Gum, sugar, and woody fibre are examples of the former; lime, potash, iron and saline matters are examples of the latter.

The amount of inorganic matter in plants varies from one to twelve per cent of their whole weight, according to their different natures; 100 pounds of wheat contains 1.18 pounds of ash or inorganic matter; 100 pounds of rye contains 1.04 pounds; 100 pounds of barley contains 2.35 pounds; 100 pounds of oats contains 2.58 pounds; 100 pounds of wheat straw contains 3.51 pounds of ash; 100 pounds of rye straw contains 2.79 pounds; 100 pounds of barley straw contains 5.24 pounds; 100 pounds of oat straw contains 5.74 pounds.

If we have an acre of land which yields us 1,500 pounds of wheat and 2,000 pounds of straw, it has taken from the soil about eighty-eight pounds of mineral matter.

An acre of land which bears a crop of oats, consisting of one ton of straw and forty bushels of grain, will abstract one hundred and fifty-six pounds of mineral matter from the soil.

The mineral matter absorbed by growing plants does not exist in the soil in unlimited quantities, but in definite quantities that can be exactly ascertained if we resort to the proper methods of inquiry. When we have ascertained the absolute amount of mineral matters required by plants in the soil, if we divide the whole number of pounds of these matters in an acre of soil by eighty-eight, we shall know the exact number of crops of wheat that can be taken from an acre; and if we divide it by one hundred

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and fifty-six, we shall know the number of oat crops that can be taken.

When this number of crops has been taken from the soil, it is evident that its capacity for producing wheat or oats is exhausted and can never be restored until the missing mineral is replaced from some foreign source.

In practice, however, the soil becomes incapable of yielding either wheat or oats long before the supply of mineral matter is exhausted. A wheat plant, for instance, may absolutely starve for want of ammonia in a soil which an exact chemical analysis shows to be superabundant in ammonia, or it may perish for lack of phosphate of lime in a soil replete with that substance; or it may be unable to procure a due supply of silicic acid from a soil consisting of pure sand.

Every farmer knows that if, after it appears to be exhausted of its mineral matter, the soil is allowed to rest, exposed to the action of frosts, rains, dews and sun-light, it will, after the lapse of a certain time, recover its fertility; the phosphate of lime, silicic acid and carbonate of potash, in which it seemed utterly deficient, have now been restored to it by the operation of its own internal processes, and not supplied to it from without.

Again, it is found that, on many kinds of land, very small crops are obtained at the first plowing; but that, at every successive plowing, the crop increases. It would seem from this that plants increased in magnitude just in proportion to the diminution of the supply of food.

An attentive examination of these apparent anomalies will lead us to a clear understanding of the causes of fertility in a soil.

First—Soils may contain a superabundance of mineral matters, though they are so unevenly distributed that a larger part of the soil is so deficient in them that it may be absolutely barren. Thus, if we measure off ten square feet at one corner of an acre, and cover it thickly with lime, the opposite corner of the acre receives no benefit from the application; there is too much lime in one plat and none in the other. If the arable surfaces of the two soils are mixed together, both will be benefited and both will be more fertile. Or we may suppose that a soil deficient in phosphate of lime has a bone buried in it. After a certain time it will be found that some of the phosphate of lime and gelatine, with its included nitrogen, is dissolved, and the particles of earth in contact with the bone are saturated with the solution, and

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cannot take up any more. If we now remove the bone and bury it in unsaturated earth, another portion will be dissolved, and the soil contiguous to it will be saturated. We may thus, by successive removals and burials of the bone until it is wholly dissolved, render many times more soil fertile than if it had been left steadily in one place. There is no soil known through which the fertile matters are evenly diffused, and hence benefit must always result from mixing together the fertile and unfertile portions.

This is one of the objects sought to be accomplished by plowing land; it is because the spade accomplishes this more perfectly than any form of plow yet known to us, that so much larger crops can be obtained when that method of tillage is used.

Plows differ very widely in their power to mix soils together. Those which invert the furrow completely hardly mix it at all. Those which leave the furrow at an angle of 45 deg. mix it more intimately. Those which take a narrow furrow do it still more completely than those that take a broad one, and those that turn a furrow in two successive portions, as the sod and subsoil plow, intermingle the particles of the soil more perfectly than when it is turned in one mass.

It is obvious, from these considerations, that by bringing into contact with each other the particles of soil which had previously been separated, we increase its fertility, and therefore those kinds of plows which accomplish this object most perfectly, other things being equal, are to receive the preference.

Second—A very little reflection will satisfy a farmer that he may have abundant elements of fertility in his soil, yet he will derive no benefit from them, because they are locked up by affinities which the rootlets of the plant cannot overcome. Thus, one ton of farm yard manure may be spread over a given area of soil, and one ton of coal spread over an equal contiguous area. The plants growing in the soil covered with manure will be abundantly supplied with ammonia, while those growing in the soil covered with the coal will receive none, and cease to grow in consequence. If now we ascertain by analysis the amount of ammonia contained in each, we find that one ton of the former contains 17.4 pounds of ammonia, while a ton of the latter contains 47.6 pounds, or nearly three times as much as the manure contained.

The important practical question, therefore, for the farmer to ask is, not how much plant nutriment is contained in his soil, but

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how much is there which is in such a *physical and chemical condition as to be available* by the rootlets of the growing plant.

As the success of the practical farmer depends almost entirely upon a knowledge of these principles, it will be necessary to give a brief explanation of them, especially as it is necessary to comprehend them, if we are to attain to clear understanding of the theory of the plow.

Mr. Way filled several glass vases, furnished with stop-cocks at the bottom, with dry soils of various kinds; he then poured into each of them the drainage water from a barn yard loaded with stercoraceous and saline matters which, after it had filtered through the soils, was drawn off through the stop-cock. That which had passed through the stiffest clay came off limpid and apparently pure, the taste being almost like that of rain water; that which passed through a very sandy soil was but slightly changed in taste or appearance. The power of a soil to absorb the manurial matters seemed to depend upon the relative amount of aluminous matter contained in it, those having the greatest abundance absorbing most, those having the greatest amount of sand having the least. It was, however, established beyond a doubt that *all* soils had a peculiar power of absorbing manurial matters, which could not be separated by the action of water or by any other way than by the absorbent action of the rootlets of a growing plant.

Dr. Vœlcker has followed up these investigations with great assiduity and success. He saturated various kinds of soils with a solution of caustic ammonia, containing 23.24 grains of ammonia to the imperial gallon, and ascertained the amount of ammonia that was absorbed by each kind of soil. He thus found that 3,000 grains of a calcereous clay absorbed 2,758 grains of ammonia from 14,000 grains of the solution. From the same quantity a fertile loamy soil abstracted 2,604 grains; 3,000 grains of a stiff clay soil absorbed 2,262 grains of ammonia; 3,000 grains of a sterile sandy soil retained 3,228 grains of the solution; 3,000 grains of the soil of a rich pasture took up 1,728 grains of ammonia.

He next agitated these soils, which had been saturated with ammonia water of the above mentioned strength, with a solution of ammonia, which was twice as strong as the preceding, and found that they now, curiously enough, absorbed very nearly

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equal portions of ammonia. Thus, the total amount of ammonia absorbed by 1,000 grains of soil was, in the case of the

1. Calcareous soil	1.5193	grains of	ammonia.
2. Fertile loamy soil	1.5363	"	"
3. Clay soil	1.1240	"	"
4. Sterile sandy soil	1.5220	"	"
5. Pasture land	1.5217	"	"

Dr. Vœlcker next proceeded to verify these results by repeating the experiments in another form. He made four solutions of ammonia of varying degrees of strength, and used the same soil—a stiff calcareous clay—in all his experiments.

							Per 1,000 grains.
Solution	No. 1	contained	44.38	grains of	ammonia	per gallon, or	.634
"	No. 2	"	21.28	"	"	"	.304
"	No. 3	"	12 32	"	"	"	.176
"	No. 4	"	6.16	"	"	"	.088

The soil was saturated with each of these solutions, when it was found that 1,000 grains of the soil thus absorbed in

No. 1	1.32	grains of	ammonia.
No 2	.64	"	"
No, 3	.26	"	"
No. 4	.10	"	"

These experiments show conclusively that all soils have the power of absorbing ammonia from its solutions; that no soil can abstract all the ammonia from a solution; that all soils can take up a greater relative amount of ammonia from strong than from weak solutions of ammonia; hence a soil which had absorbed as much ammonia as it would from a weak solution took up a fresh quantity of ammonia when it was brought into contact with a stronger solution.

Dr. Vœlcker's experiments further showed that soils were equally disposed to appropriate ammonical salts as they were to absorb ammonia itself.

He next endeavored to ascertain how far the soils were disposed to part with the ammonia thus absorbed to the rain water which percolates through them. In order to accomplish this, a quarter of a pound of a soil, saturated with ammonia, was well shaken in 7,000 grains of distilled water. It was allowed to settle for three days, when the clear liquor was carefully decanted, and the amount of water contained in it exactly ascertained. The soil thus washed was again shaken in a well stoppered bottle with 7,000 grains of fresh distilled water, and settled and decanted

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as before. This was repeated seven times successively, with the following results:

First washing, removed by 7,000 grains of water...						.236	grs.	ammonia.
Second	"	"	"	"	"	... .642	"	"
Third	"	"	"	"	"	... .610	"	"
Fourth	"	"	"	"	"	... .622	"	"
Fifth	"	"	"	"	"	... .120	"	"
Sixth	"	"	"	"	"	... .193	"	"
Seventh	"	"	"	"	"	... .228	"	"
Total						2.651	"	"

Thus we see that after seven successive washings with 7,000 grains of water, or 49,000 grains of water in all, only 2.651 grains of ammonia was obtained from a quarter of a pound of soil. It had previously absorbed 4.655 grains of ammonia, and there were therefore 2.004 grains left in it after this very thorough washing.

It is very clear from this experiment that the power of soils to remove ammonia from solutions is much greater than their property of yielding it again to water.

Prof. Way discovered that soils not only possessed the power of separating ammonia, but likewise other bases from their solutions, and they held them after being so absorbed with very great tenacity. Thus, 100 grains of clay soil taken from the plastic clay formation in England absorbed 1.050 grains of potash from a solution of caustic potash containing one per cent of the alkali. It is interesting to observe that the liquid was not in this case filtered through the soil, but only left in contact with the cold solution for twelve hours.

Prof. Way has further shown that soils have the ability to separate the alkaline bases from the acids with which they are combined. He found that when saline solutions were slowly filtered through soils five or six inches deep, the liquids which passed through were deprived of their alkaline bases, as potash, soda, ammonia and magnesia, and only the acids were to be found in combination with some other base. Thus when muriate of ammonia was filtered through the soil the ammonia was removed, and a corresponding quantity of lime in combination with muriatic acid was found in the filtered liquid. In the same way sulphate of potash was deprived of its base, and the liquid collected gave sulphate of lime on analysis.

Prof. Liebig has attempted to show that this power of soils which enables them thus to attract manurial substances from their

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solutions is analogous to that by which charcoal separates coloring matters and odoriferous matters from their combinations. This is known to be partly mechanical and partly chemical. The chemical force, like that which causes the solution of substances in water, is very weak; it attracts substances to itself, but does not produce any change whatever upon the character of the substance. The coloring or the odorous matters are held in contact with the pores of the charcoal just as coloring matters adhere to the fibres of cotton or wool quite unchanged in their nature. Neither powdered pit coal nor the hard, glassy charcoal from sugar or blood have much power to attract coloring matters from their solutions, while *porous* blood or bone charcoal possesses this property in a very high degree, and among wood charcoals, those which have the greatest amount of capillary porosity.

It is just so with soils, those which have the greatest amount of capillary porosity will condense the greatest amount of manurial substances on their internal surfaces; will retain them longest against the adverse solvent action of water, and will give them out most readily to the rootlets of the growing plant. A mass of adhesive clay will absorb but a very slight amount of available manure, but if this same mass is rendered friable by mechanical processes its power of absorption is amazingly increased. In view of what has been stated, it is very clear that plowing land increases its fertility in one way by increasing its porosity by pulverization.

Again, many manurial substances exist in the soil which, being insoluble, exercise no action on the growth of plants, and contribute nothing to their nutrition; but by the slow, though regular action of the frosts and the rain, the air and the sunshine, these insoluble and refractory compounds are reduced to a soluble state, which are appropriated and held in deposit by the soil to the credit of the next cultivated crop. This routine explains the well known fact that soils, which have been cropped to the very verge of barrenness, will recover their fertility if allowed to remain long enough under the action of these climatic influences to saturate the soil with the necessary plant food which they have unlocked from their chemical combinations and given to the soil in a proper physical condition.

These changes are brought about much more rapidly when certain mechanical changes of condition are wrought upon the soil.

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Carbonic acid is one of the most active of the agents employed in bringing the insoluble inorganic matter in the soil into that physical condition when they become available as plant food; in order that this acid may be formed, it is essential that the carbonaceous matters in the soil should be brought into direct contact with the atmosphere from which they procure the oxygen necessary to convert them into carbonic acid.

So long as stagnant water remains in the soil, or so long as it is in a dense and very compact condition, it is impossible for the carbon in the soil to be converted into acid.

A supply of available phosphatic salts is essential for the growth of most cereal plants, but these salts often exist in great profusion in the soil without contributing in any way to the nutrition of plants, because they are in an insoluble condition. If now water charged with carbonic acid is allowed to circulate through the hard phosphatic nodules a portion of them will be dissolved by the acid and diffused by the water among the pores of the soil where they will be fixed in readiness for the demands of the growing plants. In this case we see another way that the fertility of the soil is increased by pulverization, because the air is admitted to the soil, which becomes the agent of converting the carbon existing in it into carbonic acid, which in its turn renders many substances which were previously useless very efficient in promoting the growth of plants.

Mr. Way shows that the agents which exercise the greatest power in retaining manurial substances in physical combination with the soil are the double silicates, which we will endeavor to explain briefly, as their recent investigation has probably prevented a large proportion of the users of the plow from becoming fully acquainted with their properties.

If pure sand or powdered quartz be fused with lime, alumina or some other alkali, they become chemically united, and are known as silicates. Thus, silica combined with potash is called silicate of potash; with ammonia, silicate of alumina, etc. These substances, under favorable circumstances, are very prone to unite together. Thus, silicate of alumina and silicate of lime are often found united together as one well marked substance having definite characters. These new compounds are called double silicates. They have the power, in a remarkable degree, of exchanging bases in a certain prescribed order. Thus, when the double silicate of alumina and soda is digested with a solution of

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some lime salt, a new compound is formed, in which the soda is replaced by lime; in the same way the lime may be supplanted by magnesia, and the latter by potash.

It is very instructive to observe that these successive replacements take place in a regular and unvarying order, which Prof. Way has determined as follows: Soda, lime, magnesia, potash, ammonia.

Thus, in the double silicate of alumina and soda, the soda may be replaced by lime, the lime by magnesia, the magnesia by potash, and the potash by ammonia; but this cannot take place in the reverse order. Ammonia will dispossess any of the articles which precede it on the list; but none of these, either singly or in combination, has the power to dispossess ammonia. The value of these double silicates is in the order in which they are placed above. The double silicate of soda is less valuable than the double silicate of lime; the double silicate of lime is less valuable than the double silicate of magnesia; the double silicate of magnesia is less valuable than the double silicate of potash, and the latter is less valuable than the double silicate of ammonia. Thus we see the admirable provision of Divine Providence, that the more valuable compound shall always have the power of displacing the less valuable, while the inferior is restrained by impassible barriers from supplanting the superior compound.

When we learn that the formation and the transformation of these double silicates from a lower degree into a higher one is greatly promoted by a porous condition of the soil, we see an additional reason for the thorough pulverization of the soil by the plow.

The distance to which the roots of a plant will extend when there is no physical obstruction to their progress through the soil is far greater than is usually supposed by those who have not actually witnessed their extension. We have seen the roots of Indian corn extending seven feet downward; the roots of lucerne will penetrate fifteen feet; onions will run downward three feet where the physical condition of the soil favors the extension of their range. It is obvious that, as the nutritive matters in the soil cannot travel to the root, the latter must therefore go to the former; and the farther the root extends, the greater the amount of food which the plant can obtain, and the greater must be its growth and nutritive capacity. The roots of plants always develop themselves in the direction of least resistance. If the roots of

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a plant have a hard, impervious soil on their right and a porous soil on their left, the roots will all be directed from the right to the left. The growth of roots takes place by the addition of new cells to their outer extremities. The newly added cell must therefore push the earth before it by a force somewhat greater than the cohesive force of the soil which it penetrates. The force required for this purpose exhausts the vital force of the plant. A thoroughly porous soil therefore relieves this exhaustion and economizes the vital force which is then directed to some other point. Plants differ greatly in their power of forcing their roots into the soil. Wheat and barley both radicate feebly and will hardly enter a stiff soil, while buckwheat will penetrate it readily. The roots of quack grass (*triticum repens*) will force their way triumphantly through the stiffest clays, while the feebler roots of timothy (*phleum pratense*) will scarcely penetrate them at all.

Jethro Tull, to whom practical husbandry is so much indebted, ascertained the range of porous land required by each kind of plant in the following manner:

In the midst of hard, impervious land he dug a trench twenty yards long, in the form of a truncated wedge, the transverse width of the narrow end being two feet, and the broad end being twelve feet wide. In the fine, loose earth of this trapezoid he planted along the middle line, at distances of one yard apart, the plants whose root range he desired to ascertain. The plant one yard from the narrow end was smaller than that which was two yards from it, and this latter was smaller than that which was three yards distant. When he found the point where the plants ceased to enlarge and remained of the same size until that which was nearest to the widest end, he believed that he had the measure of the normal length of the root of that plant; thus when the trapezoid was planted with turnips each turnip was larger as it receded from the narrow end until the fifteenth, from thence to the twentieth the turnips were of equal size. Measuring laterally from the fifteenth turnip, he found that the range of loose soil was four feet, which he therefore concluded was the natural length of the turnip root.

When the first settlers of Ohio began to cultivate the rich valley of the Scioto, they subjected it to a very imperfect and shallow cultivation; two or three inches was the utmost depth of the plowing, but such was the great natural fertility of the land that the crops of Indian corn averaged seventy bushels to the acre.

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Successive crops of corn have been annually taken from the soil ever since, but the average product has run down to about forty bushels to the acre. In the year 1862 a large field was plowed with the sod and subsoil plow to the full depth of eight inches. The result of this experiment was that the land produced one hundred and twenty bushels to the acre, while the skim plowed land contiguous to it yielded but forty bushels.

These facts show an additional answer to the question, "How does plowing increase the fertility of the soil?" They tell us very clearly that it is by affording facilities to the extension of the roots, and thus extending the range of pasture for the plants.

The answers already given by no means exhaust the question. There are still many important uses of plowing which are yet undescribed. The germination of seeds requires seclusion from light; they must therefore be placed beneath the surface. They also require the presence of atmospheric air; without it the radicle will not enter the soil nor the plumule protrude into the air; nor will the starchy matters stored up in the cotyledons be transformed into sugar for the nourishment of the young plant. Pulverization of the soil is therefore essential, that the seeds may be regularly secluded from the light; but in such a way that the air can penetrate very freely to them. These conditions are completely fulfilled when the land is properly plowed.

Stagnant water in the soil, by cutting off the access of air to the roots of plants, prevents their nutrition and consequently their growth. Deep plowing diminishes this evil by permitting the water to penetrate deeper into the ground.

Warmth of the surface soil is essential to the growth of crops. When water lies upon the surface, it is taken up again into the air by evaporation, which causes the absorption of an immense amount of sensible heat which it renders latent. The cooling of surfaces by evaporation is made practically familiar to us whenever we wash our hands or wet our heads. Deep plowing and thorough pulverization, by permitting the water to sink into the ground, diminishes the amount of evaporation from the soil, and thus prevents the temperature of the surface from being lowered.

The exhalation of moisture from plants into the air is very great. In the experiments very carefully made by Hales, he found that a sunflower three and a half feet high, with a superficial area of 5.616 square inches, perspired at the rate of from twenty to thirty ounces in twelve hours, or seventeen times more than a man

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would do under similar circumstances. A vine with twelve square feet of foliage exhaled at the rate of five or six ounces a day. An acre of Indian corn, having 1500 plants on an acre, would exhale about one ton of water in a day. If this moisture is supplied by the roots from the reservoirs of water in the ground as fast as it is exhaled, no mischief is done; on the contrary, the plant is benefited by the increased vital action which ensues. If, on the other hand, the supply from the ground is *less* than the amount evaporated, the plant withers and finally dies.

Every farmer is familiar with the curling of the corn leaves when the evaporation is most rapid under the fierce heats and the blue skies of midsummer, especially when the surface is baked hard. He also knows that the true antidote to this condition is a thorough pulverization of the soil. When this is effected, the stores of moisture in the depths of the earth are pumped up by the capillary attraction of the interstices of the soil, and the balance between supply and demand is once more restored.

Soil in a finely divided state radiates heat much more rapidly than when its surface is hard and baked; it will therefore cool more rapidly. Dew is deposited in the clear nights most copiously on those bodies which are relatively colder than the surrounding air. It follows from this, that when two contiguous acres of land are planted with an equal number of corn plants, they will both exhale the same amount of moisture from their leaves; but if the soil of one of the acres is thoroughly pulverized, and the other is hard baked, vastly more of the daily exhalation will be returned to the pulverized soil than to the hard one, on account of its superior radiant powers. The pulverized soil will thus be supplied with water at the expense of the other.

No soil can produce maximum crops of any kind where the food of the desired kind of plant is taken up and appropriated by weeds. It is therefore one of the prime objects of agriculture to destroy them, and at the same time to utilize them so as to make them restore to the desired plant that nutriment of which they have already robbed it. Other things being equal, that plow is best which most completely buries the weeds growing on the surface and secures their decomposition, so that the roots of the growing plant can avail themselves of the food stowed away in the cells of the weeds.

We have now completed the task we proposed to ourselves, by showing all the objects which it is proposed to accomplish by the

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use of the plow in order that we may be enabled to ascertain what form of the plow is most likely to secure the ends which we have in view. They are:

First—To pulverize the soil with a view to promote those chemical transformations which will unlock the food of plants from its combinations with unassimilable elements and put it into such a physical condition as will make it accessible to the rootlets of the plant.

Second—To pulverize it with a view to facilitate the formation of the double silicates.

Third—That the roots may freely permeate the soil in all directions, thus increasing the range of their pasture.

Fourth—To promote the germination of seeds.

Fifth—To get clear of stagnant water from the surface.

Sixth—To prevent the refrigeration of the soil by evaporation.

Seventh—To secure the return of the water evaporated by the plant in the form of dew.

Eighth—To destroy the weeds in the soil.

Ninth—To utilize them and convert them into food for plants.

All plows known to us press downward upon the subsoil with a weight proportioned to the depth of the furrow slice and the density. This downward action combined with the sliding action of the shares has a necessary tendency to pack the subsoil and to polish the surface. This effect is cumulative, and every successive plowing increases the evil until the bottom of the furrow becomes so dense that neither rain nor air nor the roots of plants can possibly penetrate beneath it. The spade avoids this difficulty. Hence, other things being equal, a plow which leaves the bottom of the furrow in the same state in which the spade leaves it would have a very decided preference.

Guided by the principles which we have now so fully explained, we have drawn up a series of practical directions which will be found inserted in the Programme, page 3, under the head of "Duties of Judges," which, if they have been fully carried out in the spirit in which they were devised, we believe will settle conclusively nearly all the questions in practical plowing which have heretofore been left undetermined.

We have not sought to give a complete and exhaustive enumeration of all the objects which the plow is designed to accomplish, such as the mellowing of the soil by frost and the destruction of insects, but only those which involve the peculiar form of the the plow and the principles of its construction.

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CHAPTER VII.

ON SOME OF THE PRACTICAL QUESTIONS IN PLOWS AND PLOWING.

PULVERIZATION.

As stated in our chapter "On the objects to be accomplished by plowing," our convictions are strong that the primary object of the process is to mellow the ground by *direct* pulverization. We have never seen this stated as desirable in any of the English books or periodicals to which we have had access.* They all design to effect the pulverization of the soil *mediately* by plowing, but they always expect to effect it *immediately* through the harrow. They must first turn over the soil, laying it in sharp and well defined ridges, mathematically parallel to each other. But this darling sharpness of ridge cannot be obtained unless the slice is turned over with the least possible disturbance of the relations of its particles with each other; hence a structure which would effectually pulverize the soil and injure the sharpness of the crest would so offend the superstitious prejudices of English plowmen that not one could be sold in any of the markets of the kingdom.

This superstition was transmitted to America, and until very recently the lines of American plows have been formed on English principles. The importance of thorough pulverization was recognized by American farmers at a much earlier period than it was in England; but as they had not thoroughly studied the relations of the lines of the plow to the comminution of the furrow slice, they were unable to realize their ideal of perfection in practice.

Let us suppose a series of sheets of pasteboard to be superimposed as at A, Fig. 74. It will be seen that the edges, *a b*, are in a straight line, at right angles to the line *c a*. If we now press a thumb on *d*, and, with the other hand, raise up the corners of the sheets at *b*, the edges of the sheets will no longer be in a line at right angles with the line of the upper sheet, but the upper sheets will have advanced beyond the lower ones. Before the

* Perhaps we should except "Talpa" from this remark, but the author of that work did not expect to pulverize the soil by a plow, but with some instrument which should throw out the earth like a woodchuck.

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flexure, the edge *b*, touched the dotted line at *e;* it is now separated from it by the space *b e*, and each successive sheet is seen to be in advance of the one beneath it. To produce this successive advancement of the upper sheets, each must have moved over the surface of the other. Every plowman* knows that the furrow slice has a certain amount of elasticity, that is, the parts may be displaced to a certain extent, and then, on the removal of the displacing forces, they will return to their former position. This elasticity varies with the nature of soil. In some the slightest displacement will cause a permanent disruption; in others it will stretch considerably before disruption takes place. The bending upward, as shown in the figure, is precisely what is done by the plow, the point of the plow being directly beneath *d*, and the point, *b*, resting on the mould-board a little to the right of the shin. Let us suppose that the soil of the furrow slice, B is the most elastic, and that the distance, *b e*, is just sufficient to overcome that elasticity, then it is evident that every soil whatever will be split horizontally into flakes at its lower edge by a plow having that elevation. We say at its *lower* edge because, as the upper edge does not move through a space equal to *b e*, and as that is the precise point where the elasticity of the slice is overcome, any less motion will fail to split the layers. It follows, from this reasoning, that every kind of soil should have a mould-board specially adapted to it, if we would obtain the greatest economy of power, because the more blunt is the entering wedge, the greater will be the draught; and it would be uneconomical to use an entering wedge sufficiently blunt to flake up a stiff clay for a light loam where a much more acute angle will suffice. Still, if economy of power is not an object, a plow which will separate the most tenacious soils longitudinally will be sufficient for all soils that are less so.

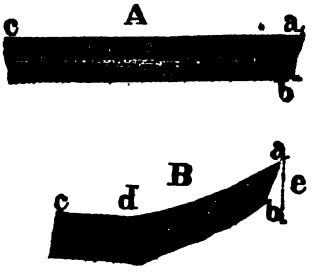

Fig. 74.

Our object is, as we have said, to pulverize the soil; but splitting it longitudinally is not pulverizing it. To accomplish this object we must split it in other directions. Jethro Tull, as we have stated, invented a plow with four coulters, figured in Plate I, which made four vertical sections through the slice. This can

*See Tull's remarks, page 18.

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be better done by a proper twist. If the furrow slice is twisted with a force insufficient to overcome its cohesion it will assume the form (Fig. 75) represented in section at B. The radius, *a b*,

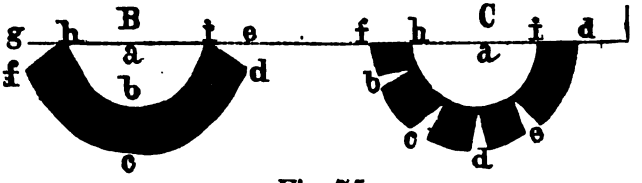

Fig. 75.

is shorter than *a c*, hence the arc at *b* is smaller than that at *c;* but the lines before flexure were equal in length, therefore while the inner circle, *h b i*, forms a complete semicircle the outer line, *f c d*, falls short of being a semicircle by the distances *d e* and *g f*, and the lines *d i* and *f h*, which were before parallel with each other, now when bent into the curve form an acute angle. Suppose the twist is increased until the force of cohesion is overcome, the section now breaks asunder as at *b c d*, &c., the fracture being greatest at the outer circle and growing smaller as it approaches the inner one; the edges *f h* and *i d* are again parallel, and are in fact in the same straight line. We have thus accomplished by a twist applied at the right point all and more than Tull accomplished by his four coulters.

We have now, as shown in the furrow slice, Fig, 76, by a proper adjustment of the entering wedge of the plow, split it into layers on the face, *c d*, the fissures running through to the opposite face, and also by a proper arrangement of the twist we have split it on the face, *a b*, through to the bottom. These fissures are seen crossing each other at right angles on the end, *a c*.

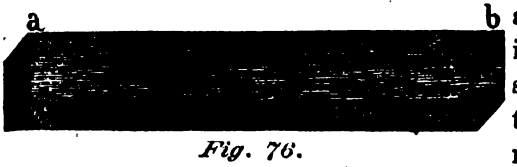

Fig. 76.

By a proper adjustment of the wing of the mould-board we may break the slice in still another direction. Suppose the wing of the mould-board were to be turned at right angles to the direction of the ascending slice, as in Fig. 77. Then the ascending slice, *e d f c*, would be compelled to change its direction from the line *e d* to the line *a b;* but to accomplish this the particle of earth at *d* would move through the arc *b d*, while the particle at *f* would only move round the centre. Now it is evident that since each particle in the dotted line *f d* is moving

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with a different velocity the continuity of the line *f d* will be broken, and a fracture will occur at the point *f* represented by *b f d*, and it is also evident that every successive line of the slice *e d f c* will be subject to a similar fracture on passing the point *f*. It is, however, unnecessary to have so large a fracture; as the slightest fissure is all that is required, we may therefore very greatly diminish the angle of the wing with a great saving of the power required, as at Fig. 78, where *b f d*, the angle of fracture, is seen to be very greatly reduced, although the actual pulverization is quite as well performed as it was with the much larger angle, *b f d*, in Fig. 77.

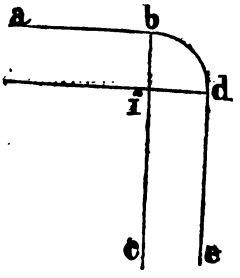

Fig. 77.

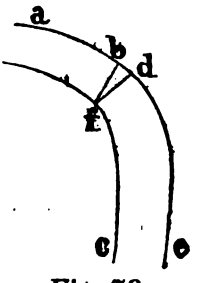

Fig. 78.

We have now, in addition to the longitudinal fissures shown in Fig. 74, on the sides, *a b* and *c d*, another series of transverse fractures across the face, *e d*, Figs. 75 and 77, made by the lines of the plow, which must necessarily break up the slice into fine particles, which will admit air and moisture, and facilitate the chemical transformations in the soil which we have shown to be so essential for the development of its latent fertility.

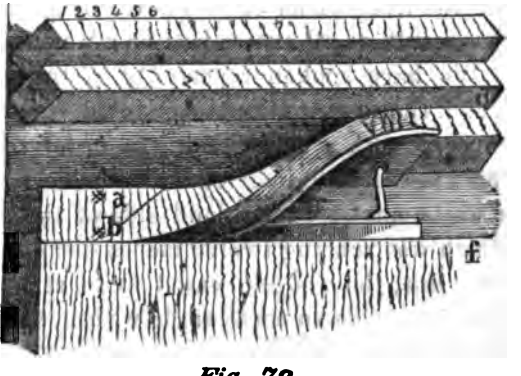

Fig. 79.

It is shown in the History of the Plow, which we have attempted to sketch, that the efforts of all the inventors who have applied their skill to the improvement of the mould-board, have been directed to the formation of a perfectly curved or twisted wedge which should be entirely regular in its formation, that is, that the third line should depart from the plane of the second precisely as far as the second does from the plane of the first, and that the fourth should depart from the third precisely as much as the third does from the second, and so on. This is especially true of the plows which are

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avowedly formed on mathematical principles, as Jefferson's, Stephens', Rham's and Knox's. Indeed, their object in invoking the aid of mathematical principles was to insure this perfect regularity in the twist of the mould-board.

If we are correct in the principles laid down above, the makers of plows have been in error with regard to the desirableness of a uniform twist in the mould-board. We grant that where economy of power is the sole object, the twist must be regular and gentle; but where the primary object is to mellow the soil, then *irregularity* in the lines becomes indispensable.

We have shown that, in order to secure thorough pulverization, the surface of the mould-board must be adapted to fracture the slice in three several directions. It is therefore plain that there must be three points, at least, where the twist must be intensified so as to insure the desired result, and at these points, *at least*, the regularity of the curve must be interrupted, so as to overcome the maximum elasticity of the soil.

The conclusion to which these views lead us is, that the best plow must have irregular lines of curvature to an extent which will insure the fracture of the furrow slice in three directions; but the irregularity should never be greater than will accomplish this result, as all excess will be a waste of power.

We have spoken repeatedly of the *elasticity* of the earth of which the furrow slice is composed, especially when its surface is covered with a tough sod. In order to measure the extent of this elasticity we inserted two wooden wedges, *a* and *b* (Fig. 79), at right angles to the land side of the furrow; when the plow, which was running twelve inches deep, came up with them at the zero line, the wedges ceased to be at right angles with the land side, but made an acute angle with it, and the wedge *a'* was seven inches in one instance in advance of the wedge *b'*, and this was the measure of the elasticity of the slice, as the two wedges resumed their former relative positions when the furrow was completely turned over. There is considerable difficulty in making the experiment, as the slice is generally broken before it arrives at the zero line. We repeated it many times unsuccessfully. We found the stretch of the land side of the furrow twice to be six inches, and only once did it cohere until it was stretched seven inches.

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ON THE DRAUGHT OF PLOWS.

In our inquiries respecting plows, their draught, or the power, which must be applied in order to enable them to perform the work required of them, is an element of the greatest interest, and our inquiries naturally resolve themselves into the following questions:

First—What power is required to plow a furrow of a given size with the same plow in soils differing in their cohesive properties?

Second—What is the power required to draw different plows through the same soil with furrows of equal size?

Third—What proportion of the power required by a plow is used by the sole? What by the land side? What by the share? What by the coulter? What by the mould-board?

Fourth—Does the wheel add to or diminish the draught of the plow?

Fifth—Does increased speed produce an increase of traction, and if so, in what proportion?

It was our intention to have answered all these questions by varied and frequently repeated experiments, but when we were ready to enter upon this branch of the investigation, we found that the Express company, in consequence of a misunderstanding of their instructions, had shipped the dynamometer, and we were therefore unable to carry out our intentions. A few experiments were, however, made which we shall report in this connection. We would, however, in view of the great importance of the subject, strongly recommend to the Executive Committee of the Society to carry out these experiments next spring in the most thorough and satisfactory manner.

Such trials as have been made by various experimenters at different times and in various places which have come to our knowledge we have brought together here for the information of those who are interested in such subjects.

The most instructive series of experiments on these points which have been made hitherto are those of Mr. Pusey, which are detailed in the first volume of the Journal of the Royal Agricultural Society. The following experiments give some approximations to an answer to the first question, viz: "What power is required to plow a furrow of a given size, with the same plow, in soils differing in their cohesive properties?" Fergusson's swing plow, taking a furrow five inches deep and nine inches

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wide, showed a draught in a sandy loam of 266 pounds; a loamy sand, 266 pounds; a moory soil, 322 pounds—increase, 21 per cent; a strong loam, 490 pounds—increase, 84 per cent; a blue clay, 700 pounds—increase, 163 per cent.

In our trials, Collins & Co.'s steel plows, with a furrow twelve inches wide and twelve inches deep, showed a draught in an indurated clay soil, mixed with coarse gravel, of 613 pounds; an unctuous tough clay of 705 pounds, the increase being 15 per cent. Holbrook's plow, taking the same furrow, and in the same soil, showed a draught in clay and gravel of 615 pounds; unctuous clay of 671 pounds; difference 9 per cent.

From these data it is obvious that the draught of plows taken in *different* soils cannot be compared with each other since the difference in the power required to overcome their cohesion has, by actual trial been found to extend to one hundred and sixty-three per cent, and it is quite probable that future trials may disclose even wider differences than this.

In answer to our second question, "What is the power required to draw different plows through the same soil, with furrows of equal size, we have the following experiments by Mr. Pusey. The furrow was five inches by nine inches:

PLOWS.	Sandy loam.	Blue clay.	Loamy sand.	Strong loam.	Moory soil.	Average.	Per cent of av'ges.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Fergusson' Scotch swing.....	266	700	266	490	322	406	34
Clark's Scotch swing.....	280	728	238	462	322	406	34
Hart's Berkshire one-wheel...	196	602	168	322	224	201	....
Ransom's FF two-wheel.....	196	602	182	462	196	329	9
Ransom's FF swing.....	252	616	224	420	294	364	21
King's swing.....	252	672	210	378	266	350	16
King's one-wheel	238	602	238	420	252	360	16
Rutland Ransom two-wheel...	238	700	224	504	294	392	30
Old Berkshire wheel plow.....	322	728	294	504	350	441	46
Holkham plow, two wheels...	252	.....	.....	.....	.....	.....	....
Averages	250	661	227	440	280	371	23

We learn from this table that there is a difference between plows in the same soil, and with equal furrows of forty-six per cent in the extreme case of the Old Berkshire as compared with Hart's one wheel Berkshire, while the average difference in the draught of nine plows was twenty-three per cent.

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The column headed "Per cent of averages" is intended to show the excess per cent of the average draught of each plow in the five different soils over the draught of Hart's one wheel Berkshire, as for instance Ransom's F F two wheel plow required on an average in all the soils nine per cent more power than Hart's, &c. In order to make this point still more intelligible, we have calculated the following table, showing the excess of power per cent required for each plow over Hart's as shown in each kind of soil:

PLOWS.	Sandy loam.	Blue clay.	Loamy sand.	Strong loam.	Moory soil.
Hart's Berkshire one wheel	00	00	00	00	14¼
Ransom's FF, two wheel	00	00	8¼	43½	00
King's one wheel	21	00	41¾	30¼	28¼
Rutland Ransom, two wheels	21	16	33¼	56¼	50
Ferguson's Scotch Swing	36	16	58¼	52	64¼
Clark's Scotch Swing	43	21	41¾	43¼	64¼
Ransom's Swing	28	2¼	33¾	30¼	50
King's Swing	28	11¼	25	17¼	35¼
Old Berkshire wheel plow	64	21	75	56¼	78¼
Averages	28	9¼	35	37	23¼

This table will be found an exceedingly instructive one, which we urgently advise every farmer and plowmaker to study with profound attention. It shows that in a sandy loam the difference between the minimum draught (Hart's and Ransom's F F) and the maximum (old Berkshire) amounts to sixty-four per cent. Two horses would thus draw Hart's plow with much greater ease than three horses would draw the Old Berkshire. In the loamy sand the excess is still greater; the latter plow would require three and a half horses to do the work that the other would do with two. Alderman Mechi estimates the cost of keeping a horse in England for one year at £39 ($195), and it is no less in this country. If this estimate is correct, a farmer would save at the rate of $292.50 a year by using the lighter instead of the heavier plow. An examination of the other columns of per centages will show the saving which will be effected by the use of each. The table also shows how greatly the economy of cultivation is affected by cohesive soils. The average draught of all the plows in the sandy loam is 250 pounds, while the average draught in blue clay is 661 pounds; hence, while the farmer on the sandy loam is compelled to pay $195 for his power, the farmer on the stiff clay must pay $515 for cultivating the same area.

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The table also shows in a very striking manner how necessary it is that plows should be specially adapted to the soils in which they are intended to work. Thus Hart's plow works the easiest in all soils except the moory soil, in which Ransom's F F excells it by fourteen and one-third per cent, while in the strong loam Hart exceeds Ransom by forty-three and a half per cent, and loamy sand by eight and one-third per cent. Ransom's Rutland excels Furguson's Swing by fifteen per cent in sandy loam, while in strong loams Ferguson excels Ransom by four and a half per cent. This question of the adaptation of plows to different soils and situations has been too much overlooked even by intelligent farmers, and it shows very clearly that the plow for "all kinds of work," which so many of them are looking and longing for, will never be devised by the ingenuity of man. If a farmer desires *perfect* work the plow to accomplish it must be made expressly for the soil and the conditions of the work, and if he uses any other kind he must pay the penalty in a waste of power and an imperfection in the work.

A series of experiments having for their object an answer to the question we are discussing, was made by Mr. J. C. Morton, and given in his Encyclopedia of Agriculture. The ground was a deep, silicious loam, above the quartoze conglomerate of the old red sandstone formation, and was of a uniform texture. The results of the dynamometer were taken with a self recording arrangement, and every care was taken to obtain perfectly correct results. The size of the furrow was in all cases six inches by nine inches.

PLOWS.	Pounds.	Per cent.
Wilkie's	581	22
Barrowman's	644	35
Fergusson's	560	17
Beverstone	478	00
Barrett & Exall's D P	567	18
Ransom's one-handled	.....	.....
Averages	566	18

In these experiments the same difference appears between the draught of plows in the same soil and with a furrow of the same size, as was disclosed in Mr. Pusey's experiments, but it is not so great in amount, the draught of the heaviest exceeding that of the

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lightest by thirty-five per cent, and the average of the five by eighteen per cent.

The trials made by this Society in 1850 were on stubble land, the soil being a stiff loam inclining to clay, mingled with stones of various sizes, near Greenbush. The following table shows the differences in the draught of the plows tried at that time:

PLOWS.	Pounds.	Per cent.
Wilkie's Scotch, A. Fleck	487	42
Subsoil and sod, French & Smith	406	19
Washington Co., Iron Beam, D. Eddy & Co	439	28
John Randerson's	342	00
Miner & Horton's, Peekskill	363	6
Starbuck & Co., Trojan	379	11
P. Auld, Improved Scotch	373	9
Prouty & Mears, Centre Draft, No. 5½	383	12
Bosworth, Rich & Co., Iron Beam, D	425	24
R. R. Tench & Co., Empire, A 3	456	33
H. L. Emery, Albany	427	24
W. W. Chase, Amsterdam, No 6	343	½
E. J. Burrall, Shell-wheel	350	2
Prouty & Mears, Connecticut Valley	525	53
Average	407	19

The furrow slice in the above trials was seven inches by ten inches.

In this series of experiments we find the difference between the heaviest and the lightest plow is equal to fifty-three per cent, and the difference between the lightest plow and the average draught of them all was nineteen per cent.

Summing up the results of the three sets of experiments, we have:

Mr. Pusey's Experiments—Maximum difference, 78½ per cent; average difference, 23¼ per cent.

Mr. Morton's Experiments—Maximum difference, 35 per cent; average difference, 18 per cent.

New York State Agricultural Society's Experiments—Maximum difference, 53 per cent; average difference, 19 per cent.

Average of the three experiments—Maximum difference, 55½ per cent; average difference, 20 per cent.

Which may be taken as the best answer that can yet be given to the second question.

The third question which we have proposed is, "What proportion of the power required by a plow is used by the sole? What

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by the land side? What by the share? What by the coulter? What by the mould-board?"

The first question is answered by Mr. Pusey's experiments, as follows:

PLOWS.	Surface draught.	Weight of plow.
	lbs.	lbs.
Fergusson's Swing	168	180
Clark's Swing	168	180
Hart's Wheel	42	168
F F Wheel	112	179
F F Swing	140	147
King's Swing	112	112
King's Wheel	84	140
Old Berks' Wheel	112	.....
Rutland Wheel	112	210
Average	117	164

The average draft of these plows working in strong loam, and with a furrow of five inches by nine inches, was, as we have seen, 440 pounds. Hence the ratio of the power consumed by the friction of the sole to the whole power is as 1:3.76.

We have met with no experiments having for their object the determination of the friction of the land side separately from the other portions of the plow.

The only experiments known to us on the influence of the share on draught are those of Mr. Morton, which, although they do not give a complete answer to our question, are sufficient to show that this part of the plow exercises a very important influence upon the action of it. The draught of Ferguson's Swing plow, with a share ten inches wide, was 630 pounds, while the same plow, with a share six inches wide, drew only 560 pounds. In the former case the whole of the lower portion of the furrow was cut off; in the latter case four inches on the right side of the furrow were uncut, and were *torn* off by the wedge of the share and mould-board. The experiment shows that the cutting of these four inches and the increased friction of the wider share increased the power required to the extent of twelve per cent.

The experiments of Mr. Stephens seemed to show that it required exactly the same power to draw a coulter through the ground as it did to draw the plow without a coulter; but this experiment needs verification.

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According to Mr. Morton's experiments the whole draught of the plow is 476 pounds; the removal of the mould-board diminishes this only to 434 pounds; in other words, only ten per cent of the whole draught is caused by the turning of the furrow slice. The draught of the plow running along the open furrow was 168 pounds, which, being subtracted from 434 pounds, the draught without the mould-board, leaves 266 pounds as the draught required for the *cutting* of the furrow slice. Should this division of the draught hold generally true, we may infer that the labor of plowing may be distributed as follows: Thirty-five per cent for the weight of the implement; fifty-five per cent to cutting of the furrow slice, and only ten per cent to the action.

This conclusion, if correct, will change the former current of opinion to a very great extent. Great labor has been expended upon the mould-board, upon the hypothesis that the draught depends to a very great extent upon its shape, but it will be seen that the share, the coulter, and the weight of the plow are far more promising points for its improvement than the mould-board.

The effect of the friction of the sole upon the draught has been known to plowmakers for a long time, and many attempts have been made to diminish it by the addition of a large wheel near the heel, in such a position that the plow nearly balances over it, and by the introduction of friction wheels on the land side. At the trial at Albany in 1850, Mr. Burrall exhibited a plow with one of these wheels. At first its draught was very light, though not as much so as some of the plows which were not furnished with this appliance, but after working some time the wheel became clogged by the loose earth, and it then became decidedly heavier than those which were formed in the usual manner.

Another experiment which was tried by Mr. Pusey, with a view of determining the ratio of the draught to the depth of the plowing, may be usefully stated in this connection.

The experiment was made on a free, brown loamy sand of a good quality, without stone, gravel or clod, resting on a pure, yellow sand on the coral sag formation. The results are given in the following table:

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PLOWS.	Furrow, 4 by 9 in.	Furrow, 5 by 9 in.	Furrow, 6 by 9 in.	Furrow, 7 by 9 in.
Fergusson's Swing Plow	252	266	266	308
Clark's Swing Plow	238	238	252	294
Hart's One-wheeled	154	168	224	252
F F (Ransom's) Two-wheeled	168	182	252	294
F F (Ransom's) Swing	224	224	252	294
King's Swing	210	210	252	280
King's One-wheeled	224	238	294	322
Rutland N L Two-wheeled	224	224	252	280
Old Berks	294	294	336	434
Average	221	227	264	306

The increased average draught of the first inch is 2.71 per cent; of the second inch, 16.29 per cent, and of the third, 15.91 per cent. Average, 11.63 per cent.

Mr. Pusey made a second experiment to determine this point a few days afterwards upon a poor, moory soil, with Ferguson's Scotch plow, with the following results:

Furrow, nine inches wide.		
FURROW—Depth in inches.	Draught in lbs.	Increase, per cent.
5	322	.....
6	308	.....
7	350	8.70
8	420	20.00
9	434	3.33
10	560	29.03
11	700	25.00
12	700	.....
Average	474	12.29

The experiments on this point made by Mr. Morton are given in the following table:

Furrow, nine inches wide.					
FURROW.	Fergusson.	Beverstone.	Barrowman.	Barrett.	Average pounds.
Depth in inches.	Pounds.	Pounds.	Pounds.	Pounds.	
4	462	378	574	354	442
6	560	476	644	560	560
8½	840	896	854	.....	863
Average	621	583	690	457	621

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Increase.			
PLOWS.	Between 4 and 6 in.	Between 6 and 8½ in.	Average per cent.
	Per cent.	Per cent.	
Of Fergusson's	21.21	50.00	35.50
Of Beverstone's	25.92	88.23	57.07
Of Barrowman's	12.19	32.61	22.40
Of Barrett's	58.18	.....	58.18
Average	29.37	56.94	43.31

The average increase of power for each inch in depth of Ferguson's plow was 7.90 per cent, or 84 pounds; Beverstone's plow was 12.68 per cent, or 115 pounds; Barrowman's plow was 4.98 per cent, or 62 pounds; Barrett's plow was 12.92 per cent, or 103 pounds. Average, 9.62 per cent, or 91 pounds.

Our own experiments on this point were very meagre, on account of the mistake in sending off the dynamometer heretofore alluded to, but as the subject is of so much importance we give them here. The experiment was made in a very hard soil, with gravel indurated in the clay, and all the plowing was deeper than any previous plowing, so that in each case the plow went into soil which had never been disturbed before. The plow used was Holbrook's No. 100; furrow ten inches wide. At 8½ inches deep, 659 pounds; at 10½ inches deep, 753 pounds—increase, 94 pounds; at 12½ inches deep, 801 pounds—increase, 48 pounds. The average increase of power for each inch of depth in this case is 35 pounds, or 5.38 per cent.

We can most fully corroborate the correctness of Mr. Pusey's remark, that this is a very difficult experiment to make. It is hard to preserve the exact depth of one inch more or less; sometimes it will run up or down considerably more than an inch. Sometimes when plowing at a given depth the share will encounter a mass of roots which resist very greatly, while in plowing an inch deeper we do not encounter these obstacles, and the plow at that depth does not appear to draw as heavily as it did when plowing an inch shallower. Owing to these inequalities in the texture of the soil at different depths, we need not expect to meet with any very regular law of progression in the draught in the indications of any particular table; but by having recourse to averages, the indications of a uniform law of increase begin to develop themselves sufficiently to assure us that when a sufficient

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number of experiments shall have been carefully made we may ascertain the law nearly enough for all practical purposes. The average increase of draught per inch in Mr. Pusey's experiments was 12.29 per cent. In Mr. Morton's experiments it was 9.62 per cent, and in our own experiments it was 5.38 per cent. The average of all these is 9.09, say in round numbers, ten per cent of increase in draught for each additional inch depth of furrow between the limits of four and twelve inches.

If this conclusion approximates to correctness it appears that the draught increases in proportion to the depth much less rapidly than has been heretofore supposed. Mr. Pusey says that it has been laid down in our books that the draught increases as the squares of the depth; that is to say, that if the draught at four inches be 252 pounds, at seven inches it will be as 49 to 16, or 756 pounds, whereas experiment shows that on an average it is only 308 pounds, or less than half that amount.

It must not be forgotten that both theory and experiment show that plows made expressly for deep tillage will work relatively lighter in a deep furrow than in a shallow one. Thus a plow made expressly for a four inch furrow compared with one made for a twelve inch furrow will work in the furrow it was designed for with much less draught than a deep plow; but if the four inch plow is made to take a furrow ten inches deep, the plow designed for twelve inches will be found to require much less draught. This fact should never be lost sight of in trials of this kind.

We know of no experiments made with a view to determine the ratio of power required to turn over furrow slices of different breadths while the depth remains uniform.

There is another point upon which Mr. Pusey's experiments throw much light, and which led to conclusions very different from those which have been generally entertained. It has been generally supposed that the power required to draw a plow increased as the square of the velocity, but experiments show that this is not the case.

Mr. Pusey made repeated trials in order to settle this point under a great variety of circumstances. The first trial was in the moory ground mentioned in preceding tables, and with Clark's plow. The horses were made to walk as slowly as possible, and the draught was found to be 336 pounds in a five inch furrow. The horses were now urged forward at their highest rate of speed,

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and the draught was 350 pounds, which is only 14 pounds more than when they were walking slowly.

A second trial was had in an adhesive loam, in so bad a condition that the polished mould-board was completely encrusted with earth. Hart's plow was selected for the experiment, and one hundred and ten yards, or one-sixteenth of a mile, were accurately measured off. At the first trial the horses traveled the distance in two minutes and forty seconds, being at the rate of one and a half miles in an hour. The dynamometer showed a draft of 322 pounds, the furrow being four inches by nine inches. At the second trial the distance was done in two minutes and twenty-five seconds, being at the rate of one and three-quarter miles in an hour. The furrow was of the same size, and the draught was still 322 pounds as before. At the next trial the rate was one minute and forty seconds, which is at the rate of two and three-quarter miles in an hour; the draft, from some cause, was reduced instead of being increased, and stood at 308 pounds. Finally the distance was accomplished in one minute and five seconds, or at the rate of three and a half miles in an hour. The draft was indeed increased, but the increase was only 14 pounds, which might very probably be due to an increased tenacity of the soil.

The following table shows the time which would be required for plowing an acre, with a furrow nine inches wide, at the different rates of motion, exclusive of stoppages:

Rate of going per hour.	Time required to plow an acre.	Draught of plow.
1½ miles	7 hours, 20 minutes.	322 pounds.
1¾ "	6 " 30 "	322 "
2¾ "	4 " 00 "	308 "
3½ "	3 " 08 "	336 "

Mr. Morton's experiments were first with a speed equivalent to two and a half miles an hour. The furrow was four by nine inches, and the draught was 378 pounds. At five miles an hour the draught was 392 pounds. His experiments were made with a self recording dynamometer, in which the pencil described the extent of every oscillation. It is worthy of remark that these oscillations were very greatly increased at the higher rate of speed, ranging between the extremes of 210 and 644 pounds, while at the lower rate the oscillations ranged from 280 to 504 pounds.

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This result might have been reasonably expected, as when the plow strikes a stone or other obstruction the horses will naturally exert all their strength, and by so doing cause a wide sweep of oscillation.

We can say in conclusion that the results obtained upon this point by Messrs. Morton and Pusey are fully corroborated by our own observations. We could detect no difference between the draught at high or low speeds, except such as are within the limit usually allowed for errors of observation. In fact, the dynamometer sometimes showed a less draught at a high speed than it did at a low one.

This is quite in accordance with other experiments which have been made to ascertain the laws of friction, which show that it is entirely independent of velocity.

The resistance to the action of the plow is made up of the weight of the plow pressing upon the sole, with the superadded weight of the furrow slice; the friction of the land side against the earth; the friction of the furrow slice against the surface of the mould-board; the splitting action of the coulter, and the force required to lift up and turn over the furrow slice. It is only in this latter case that the real work performed is increased by the velocity, and this is so small a proportion of the whole force that it may be safely neglected in practice.

It will be seen at once by every farmer that the conclusion we have come to, in view of the experiments, is one of very great practical value. It shows, as Mr. Morton remarks, "the importance of employing draught animals which *naturally* walk at a rapid pace. Such animals, with *same effort*, get through double the work of those of a more sluggish movement. *With the same effort*, and therefore at no greater expense to the farmer. The employment of active animals is obviously one of the most influential methods of diminishing the expense of horse labor."

In view of these experiments, Mr. Pusey remarks: "Here, then, it appears to me we have found the secret of the Scotch horse's superior performance as to quality of work done. Though they are stepping briskly along at a pace which enables them to work five-quarters of an acre in a day, while the dragging walk of the other horses carries them through three-quarters of an acre only in the same time. They feel the weight of the plow, certainly not more than the others; perhaps even less. Let the horses be lively enough to face their work boldly, and step out

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well; they get, or rather their master gets, beyond the former three-quarters of an acre, two-quarters more plowed for nothing. It is true that the horses have to walk a greater distance in one case, but this cannot be of much consequence. In plowing an acre, with the furrow nine inches wide, the horse has to walk in the furrow eleven miles exactly. If, then, he plow three-quarters of an acre in a day, he has to walk eight and one-quarter miles only; if five-quarters, he must pass over thirteen and three-quarters miles—but five and a half miles more than before. The increased rate of the animal's exertion has also, of course, a great effect upon the fatigue of its frame, where the difference is considerable. But I suppose that each animal has, in some degree, a natural pace, suited to its conformation, which is most easy to it, and that the quicker rate of two and three-quarters miles in the hour may be as natural to the Clydesdale horse as a more tardy walk to cart-horses of our heavy breeds. Still I do not wish to assert that, under all circumstances, it is as easy for a horse to move quickly as slowly with a heavy draught. If he be overweighted, he will not have sufficient strength to spare for carrying on his own weight with ease, and will naturally flag at his task.

"In order to move briskly, he ought, I suppose, to feel in some degree master of his work, and be able, if required, to draw something more than his actual load. I ought also to mention, after stating the superior exertions which the horse may be called on to make, that these Clydesdale horses of Lord Moreton's are not only fed in a superior manner, but that their day's work is broken into two portions of time, between which they have rest, and either return home to be fed or are supplied by means of nose-bags, with corn, in the field. I believe that the practice of working horses for eight hours together not only adds to their fatigue, but that the absence of food for so long a time must be a much more severe privation to them (as to all animals feeding on grass and seeds only) than it is to the carniverous animals and to ourselves."

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CHAPTER VIII.

ON THE LINE OF DRAUGHT OF PLOWS.

In using a double mould-board plow it is very obvious that the line of draught will be in the direction of the middle line of such plow; that is, the resistance of the earth to the action of the mould-board on the right side of the beam tending to throw the heel of the plow to the left hand, will be exactly counterbalanced by the resistance of the earth on the left mould-board, tending to throw the heel to the right hand. These two faces being equal and contrary will therefore neutralize each other, and the plow will move steadily forward in the direct line of the draught.

This is not the case when the left side is cut off, as in our ordinary plows, and the whole of the work is done by the share and mould-board of the right side. Here the plow is acted on by a lever whose length is the breadth of the plow, the effect of which is to throw the heel of the plow against the land side, and therefore to throw the point away from land, thus constantly narrowing the breadth of the furrow. In order to obviate this tendency of the plow to run out, the English and Scotch plowmakers make their beams oblique to the plane of the land side, so that the forward extremity of the axis of the beam falls from an inch and a quarter to two inches to the right of the plane of the land side produced to that point. Although this obliquity of the beam effectually resists the tendency of the plow to run out, yet it introduces an element of unsteadiness into the motion of the plow which keeps the eye of the plowman continually upon the watch, and his hand continually in motion to rectify the aberration.

Messrs. Prouty & Mears devised a much better plan for accomplishing this object, which has been since adopted by the greater number of our American plowmakers.

They considered that there was a plane passing lengthwise through the plow, which was so situated that the forces on each side of it would balance each other. Since the greatest amount of the force required to move the plow is employed in severing the furrow slice from the solid land, it follows that the plane will lie much nearer to the land side than to the furrow side of the plow. They accordingly found, from carefully repeated experi-

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ments, that in average soils and conditions that if the land side was made with seven degrees of obliquity to the perpendicular, or eighty-three degrees to the plane of the sole, the axis of the beam would lie in the plane passing through the centre of resistance. When the axis of the beam lies in this direction the plow moves forward without any tendency to deviate from the line of motion either to the right hand or the left. This arrangement is illustrated in Fig, 80, in which a vertical section of the plow is represented. The dotted line, C D, being the perpendicular to the plane of the sole, S; the angle C D B is 7 deg.; L is the standard, and the lower part of it is the land side; M, section of mouldboard; B, section of the beam.

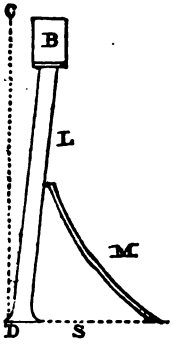

Fig. 80.

There is also a horizontal as well as a perpendicular plane of resistance. When the draught coincides with this plane there is no tendency in the plow to go deeper or shallower; if the draught is above it the point of the plow is drawn downward with a force proportioned to the height of the point of draught above this plane; if placed below it, the point of the plow will in like manner rise out of the ground, and these tendencies can only be counteracted by the plowman pressing on the handles of the plow in the former case, or lifting them by main force in the latter case.

Again, we have a third plane of resistance, which is vertical and transverse. The plow enters the unbroken earth by a single point, the transverse sections increasing gradually in area until they attain to their maximum dimensions; but as the point enters and breaks the solid earth, the force required does not increase nearly as fast as the sectional area increases, hence the position of this plane raises from one to five inches behind the point of the plow, according to the consistency of the soil and the shape of the plow.

The point of resistance of the plow is therefore situated at the intersection of these three planes. If the line of draught passes through this point, the plow will, in the language of the plowman, "swim free;" and it is therefore a point of great practical importance to ascertain the locality of the point of resistance, and to have a ready means of adjustment by which the line of draught may be made to pass through it.

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In speaking of the proper angle of draught, Mr. Stephens remarks ("Book of the Farm," page 286):

"The reasoning heretofore adopted on this branch of the theory of the plow seems to be grounded on the two following data: the height, on an average, of a horse's shoulder, or that point in his collar where the yoke is applied; and the length of the draught chains that will give him ample freedom to walk. It falls out, fortunately, too, that the angle of elevation thus produced crosses the plane of the collar as it lies on the shoulders of the horse when in draught, nearly at right angles."

It may, however, be shown that the plow may be drawn at any angle from the horizontal nearly up to the perpendicular, if certain practical difficulties were removed, and that would require a continually diminishing force to draw it as the line of draught approaches to a horizontal direction, arriving at a minimum when it reaches that point. It is, however, impossible in practice to apply the force in this direction, as the line of draught would, in this case, pass through the solid earth of the furrow slice; but it is practicable to draw the plow at an angle of 12 degrees, which, as will be demonstrated, will require less draught by fourteen pounds than would be required if the angle were 20 degrees, which may be considered as the average in the ordinary practice of plowing. A plow drawn at this low angle, viz., 12 degrees, would have its beam (if of the ordinary length) so low that the draught-bolt would be only ten inches above the base line; and this is not an impracticable height, though the traces might be required inconveniently long. On the same principle, the angle of draught might be elevated to 60 or 70 degrees, provided a motive power could be applied at such high angles. In this, as before, the beam and clevis would be in the straight line between the point of attachment at the collar and the centre of resistance. The whole plow, also, under this hypothesis, would require an almost indefinite increase of weight; and the power required to draw the plow, at an angle of 60 degrees, would be nearly twice that required in the horizontal direction, or $1\frac{16}{18}$ times that of the present practice, exclusive of what might arise from increased weight. We may, therefore, conclude that to draw the plow at any angle higher than the present practice is impracticable, and, though rendered practicable, would still be highly inexpedient by reason of the disadvantage of increased force being thus rendered necessary, unless we can suppose that the application of

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steam or other inanimate power might require it. Neither would it be very expedient to adopt a lower angle, since it involves a a greater length of trace chains, which at best would be rather cumbrous, and it would produce a saving of force of only 14 pounds on the draught of a pair of horses. Yet it is worthy of being borne in mind that, in all cases, there is some saving of labor to the horses, whenever they are, by any means, allowed to draw by a chain of increased length, provided the clevis of the plow is brought into the line of the draught, and the draught chains are not of such undue weight as to produce a sensible curvature; in other words, to insure the change of angle at the horse's shoulder due to the increased length of the draught chain."

This subject will be better understood when considered in connection with Fig. 81.

Let *a* represent the body of the plow, *b* the point of the beam, and *c* the centre of resistance of the plow, which may be assumed at a height of two inches above the plane of the sole, *d e*, though it is liable to change within short limits. The average length of the draught chains or traces being ten feet, including evener, whiffle

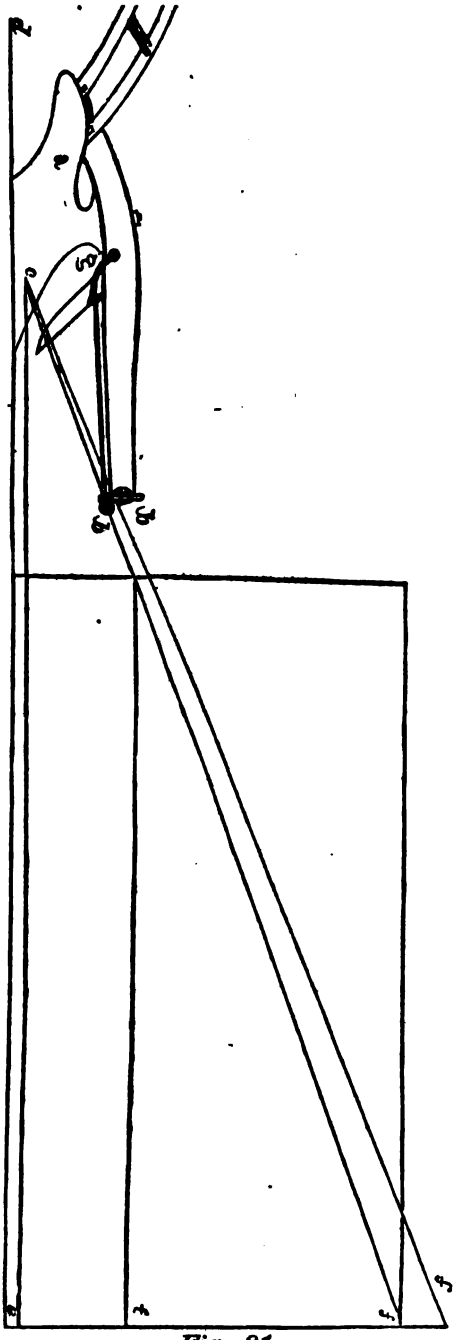

Fig. 81.

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trees, hooks, and all that intervenes between the clevis and the horse's shoulders. Let that distance be set off in the direction *b f*, and, the average height of the horse's shoulders being four feet two inches, let the point *f* be fixed at that height, above the base line, *d e*. Draw the line *f c*, which is the direction of the line of draught, acting upon the centre of resistance, *c*; and if the plow is in proper temper it will coincide with the clevis; *e c f* being the angle of draught and equal to 20 degrees. It will be easily perceived that, with the same horses and the same length of yoke, the angle, *e c f*, is invariable; and if the plow has a tendency to dip at the point of the share under this arrangement, it indicates that the draught-bolt, *b*, is *too high* in the bridle. Shifting the bolt one or two holes downwards will bring the plow to *swim* evenly upon its sole. On the other hand, if the plow has a tendency to raise at the point of the share, the indication from this is that the evener is too low in the clevis, and the rectification must be made by raising it one or two holes in the clevis.

Suppose, again, that a pair of taller horses were yoked in the plow, the traces, depth of furrow, and soil, and, by consequence, the point of resistance, *c*, remaining the same, we should then have the point *f* raised to *f'*. By drawing the line *f' c* we have *e c f'* as the angle of draught, which will now be 22 degrees; and in this new arrangement the draught-bolt is found to be below the line of draught, *f' c*; and if the traces were applied at *b*, in the direction of *f' b*, the plow would have a tendency to rise at the point of the share by the action of that law of forces which obliges the line of draught to coincide with the line which passes through the centre of resistance; hence the draught-bolt, *b*, would be found to rise to *b'*, which would raise the point of the share out of its proper direction. To rectify this, then, the draught-bolt must be raised in the bridle by a space equal to *b b'*, causing it to coincide with the true line of draught, which would again bring the plow to swim evenly on its sole.

Regarding the relative forces required to overcome the resistance of the plow when drawn at different angles of draught, we have first to consider the nature of the form of those parts through which the motive force is brought to bear upon the plow. It has been shown that the tendency of the motive force acts in a direct line from the shoulder of the animal of draught to the centre of resistance; and, referring again to Fig. 81, were it not for considerations of convenience, a straight bar or beam lying in

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the direction *c b*, and attached firmly to the plow's body, anywhere between *c* and *g*, would answer all the purposes of draught, perhaps better than the present beam. But the draught not being the end in view, but merely the means by which that end is accomplished, the former is made to subserve the latter; and as the beam, if placed in the direction *c b*, would obstruct the proper working of the plow, we are constrained to resort to another indirect action to arrive at the desired effect. This indirect action is accomplished through the medium of a system of rigid angular frame work, consisting of the beam and the body of the plow, or those parts of them comprehended between the points *b h c*, the beam being so connected to the body, *a h*, as to form a rigid mass. The effect of the motive force applied to this rigid system of parts at the point *b*, and in the direction *b f*, produces the same result as if *c b* were firmly connected by a bar in the position of the line *c b*, or as if that bar alone were employed, as in the case before supposed, and to the exclusion of the beam, *b h*.

Let us now proceed to examine the effect of the oblique draught on traction. The average draught of plows at the Albany trials in 1850, was 407 pounds, with a furrow seven inches by ten inches, when exerted in the direction *b f*. If now we take the value of the line *b f* at 407, a certain portion of the force will be exerted in direct traction, and another portion will be exerted in pulling the plow up from the ground in the direction *i f*, and the force of traction will be to the lifting force in the exact ratio of the line *i b* to the line *i f*. The line *i f* is 50 inches — 16 inches = 34 inches: the line *b f* is 120 inches; the line *i b* is therefore 115 inches; and we therefore have 120 inches : 115 inches : : 407 pounds : 390 pounds = the amount of direct draught upon the plow exerted by the horses. In like manner the force lifting the plow upwards is found to be 114 pounds. The same result would follow if the beam were supported by a wheel under the point *b;* the wheel would then bear up the beam with the same force as that by which it was supposed to be suspended, viz.: 114 pounds. But to carry out the supposition, let the draught now found be applied at the point *c;* as the plow would then have no tendency to dip or rise, the force, *k b*, vanishes, leaving only the direct horizontal force, *i b;* hence, were it possible to apply the draught in a horizontal direction from the point

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of resistance, the resistance of the plow would be 390 pounds instead of 407 pounds.

THE WHEEL.

It is not difficult to show that, theoretically considered, a wheel placed under the beam can in no case lessen the traction of the plow, as many plowmakers and plowmen have alleged.

Let us suppose that the line of draught is in the horizontal direction; it will therefore require that a support be placed beneath the beam to prevent its sinking too low, which support, in all modern plows, is given by a wheel. It has been shown that whether the plow be drawn in the ordinary direction of draught, *b f*, in which one oblique propelling force only is exerted, or with two antagonist forces, *b i*, in the horizontal direction, and the upholding force, *b k*, in the vertical, we find that in the latter the difference in favor of motive force is only one twenty-fourth of the usual resistance; but the upholding force is equal to two-sevenths, while none of these variations has produced any change in the absolute resistance of the plow. The impelling force is theoretically less in the latter case; but since the wheel has a load of 107 pounds to carry, we have to consider the effect of this load upon a small wheel, arising from friction and the resistance it will encounter by sinking more or less into the subsoil.

Mr. Stephens has ascertained from experiment that the difference of force required to draw a wheel twelve inches in diameter, loaded as above described, and again when unloaded, over a tolerably firm soil, is equal to 22 pounds, a quantity exceeding one and a half times the amount of saving that would accrue by adopting this supposed horizontal draught with a wheel. Having thus found the amount of draught at two extremities of a scale, the one being the oblique draught, in common use, at an angle of 20 deg., the other deduced from this through the medium of the established principles of oblique forces, and the latter producing a saving of one twenty-fourth of the motive force while it is encumbered with an additional resistance arising from the support or wheel. It necessarily follows that at all intermediate angles of draught, or at any angle whatever where the principle of the parallelogram of forces finds place—and it will find place in all cases where wheels *yielding any support* are applied to the plow under the beam—there must necessarily be an increase in

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the amount of resistance to the motive force. The diagram, Fig. 82, will make this important matter still more intelligible.

Let *a* be the point of resistance of a plow's body, *b* the point of the beam, *c* the position of the horses' shoulders, and *a d* the horizontal line; then will *c a d* be the angle of draught, equal

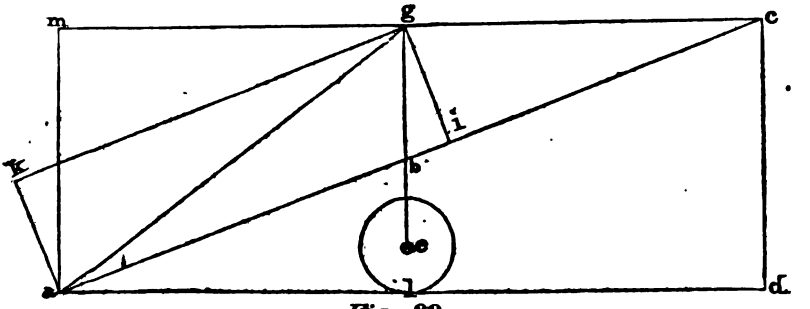

Fig. 82.

20 deg. Let the circle *e* represent a wheel placed under the beam, which is supported by a stem or shears, here represented by the line *e b*. In this position the point of the beam, which is also the point of draught, lies in the line of draught; the wheel, therefore, bears no load, but is simply in place, and has no effect on the draught; the motive force, therefore, continues to be 407 pounds.

Suppose, now, the point of the beam to be raised to *g*, so that the line of draught, *g c*, may be horizontal; and since the line of draught lies now out of the original line, *a b c*, and has assumed that of *a g c*, *g* being now supported on the produced stem, *e g*, of the wheel, draw *g i* perpendicular to *a c* and complete the parallelogram, *a i g k;* the side, *a i*, will still represent the original motive force of 407 pounds, but by the change of direction of the line of draught, the required force will now be represented by the diagonal, *a g*, of the parallelogram, equal to 425 pounds, and *g c* is a continuation of this force in a horizontal direction. The draft is therefore increased by 18 pounds. Complete also the parallelogram, *a l g m*, and as the diagonal, *a g*—the line of draught last found—is equal to 425 pounds, the side, *l g*, of the parallelogram will represent the vertical pressure of the beam upon the wheel, *e*, equal to about 250 pounds, which, from Mr. Stephens' experiments, may be valued at 50 pounds of additional resistance, making the whole resistance to the motion 475 pounds, and being a total *increase arising from the introduction of a wheel in this position* of 68 pounds. Having here derived a maximum—

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no doubt an extreme case—and the usual angle of 20 deg. as a minimum, we can predicate that, at any angle intermediate to *l a b* and *l a g*, the resistance can never be reduced to the minimum of 407 pounds. Hence it follows, as a corollary, that *wheels placed under the beam* can never lessen the resistance of the plow; but, on the contrary, must in all cases increase the resistance to the motive force more or less, according to the degree of pressure that is brought to bear, and this will be proportional to the line of the angle in the resultant, *a g*, of the line of draught.

We have now finished the discussion of the wheel question on theoretical principles, deeming it best to introduce no disturbing questions to distract the attention of the reader until all that we had to say under that head was brought to a close.

We may now remark that our theoretical views are based upon a uniform motion, a uniform soil and a homogeneous texture, but such a coincidence of conditions is rarely met with in practice. Some portions of the soil are wet, while others are dry; some parts are hilly, and others level; some parts are adhesive, and others are crumbling; some are stony, others full of roots. The instances are indeed rare where there is a perfect uniformity in the conditions which are essential to bring it into conformity with theory.

There are few questions connected with plowing which have been more energetically or more persistently disputed than that between wheel and swing plows. The Scotch plowmen have been especially pugnacious, doing battle for the swing plow with the utmost vehemence. The English plowmen have been equally certain that the wheel was essential to good plowing. While the Americans, thinking little about the matter and saying less, have instinctively adopted them.

The advocates of the swing plow claim the following advantages.

First—It educates a better class of workmen. Almost any one, after the practice of one or two days, can use a wheel plow and do pretty good work. None but a first-class workman can make good work with a swing plow.

Second—Its depth can be regulated by the proper adjustment of the whiffle-trees in the clevis, or by increasing the length of the traces.

Third—The plowman can regulate the action of the point by bearing upon or lifting up the handles.

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Fourth—It is more simple in its construction and less in cost.

Fifth—It can be used across ridges, and under a much greater variety of circumstances than the wheel plow.

Sixth—It requires less power.

The advocates of wheel plows claim the following advantages for their favorite implement:

First—The plowing can be effected with more ease to the plowman.

Second—The work can be performed with much greater accuracy; the depth is more uniform and the sole is kept more level.

Third—Where very shallow or very deep plowing is required it can be better done with a wheel than with a skim plow, and also where the land is hard and stony.

Let us briefly consider these conflicting allegations:

First—It is doubtless true that a swing plow requires a more skillful plowman than a wheel plow, but this, in a country where skilled plowmen are so rare as they are in this, is an objection rather than an advantage. No one denies that a poor workman can do very much better work with a wheel plow than with a swing plow, and this, in our judgment, settles this point in their favor.

Second—The alleged capacity for adjustment is true, but it is *equally* true of the wheel plow.

Third—This allegation must also be admitted, but it is done at a great expense of friction upon the team, and of great labor to the plowman, which increases the wear of the plow. The use of the wheel obviates the necessity of all this, and therefore we think that in this respect wheels have the advantage.

Fourth—This must be admitted, but the advantage in this respect is so slight that it is scarcely worth taking into the account.

Fifth—This assertion must be taken with some limitations. In cases where the rock lies at varying depths, sometimes within three or four inches of the surface, at others at a greater depth, in cutting across dead fallows where the surface is rough, and hard clods interrupt the even action of the wheels, there can be no doubt that the swing plow would do best. In crossing steep ridges and furrows the action of the ascending wheel raises the share out of the furrow, while in descending it plunges deeper into the ridge. This, however, occurs only in extreme cases, and

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to a considerable degree the same effect attends the swing plow unless it is managed by plowmen more expert than are often found in England or even in Scotland, and of whom scarce a score could be found in the State of New York. On the other hand, in stony land, or where the soil is obstructed by roots, it must be confessed on all hands that a wheel is of the greatest advantage.

Sixth—The assertion that the wheel plow requires more power than the swing is completely disproved by the most accurate and frequently repeated experiments.

We have shown by geometrical reasoning that the wheel adds to the draught of the plow when *constantly pressed upon* by the trim of the plow; but this ought never to be allowed, and will never occur in level and tolerably homogeneous soils, when the draught is properly adjusted. The pressure will only occur in coincidence with the occurrence of inequalities; but on the other hand, these inequalities must be overcome by the pressure of the plowman's hands, which, acting on a long lever, increases the friction in a greater degree than the wheel, and therefore augments the friction of the plow in a greater degree also.

Mr. Handley, in a paper which received the prize of the Royal Agricultural Society, details a series of experiments that he performed with a view to the determination of this question.

Two wheel plows were tried in connection with two swing plows. The average draught of the wheel plows was 288 pounds, while the average draught of the swing plows was 341 pounds, making an average difference of 53 pounds in favor of the wheel plows.

Mr. Handley's experiments were performed at Ipswich, in 1838. The average weight of the wheel plows was 220 pounds; the average weight of the swing plows was 135 pounds. It was farther established at this trial that the draught of a plow is not increased in an equal ratio with its weight, for on loading one of the wheel plows with 112 pounds, or 51 per cent additional weight, the draught was only increased 33 pounds, or 12 per cent.

These trials were repeated by Mr. Pusey in 1840, with the following results: The average draught of four swing plows, working a deep, strong loam, was 441 pounds, while that of the four wheel plows, working in the same soil, was 434 pounds. showing an average difference of 7 pounds in favor of the wheel plows in this kind of soil. In a brown loamy sand the average

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draught of the four swing plows was 245 pounds; that of the four wheel plows was 210 pounds, showing an average of 35 pounds in favor of the wheel plows. In a blue clay soil the average draught of the four swing plows was 686 pounds; the average draught of the four wheel plows was 630 pounds, showing a difference in favor of the wheel plows of 56 pounds. In a sandy loam the difference in favor of the wheel plows was 49 pounds. The average difference in these four trials, in as many different soils, was 37 pounds, or 10 per cent, in favor of the wheel plows.

Mr. Handley accounts for this superiority of wheel plows as follows:

"As regards the cause of the diminished force required by the wheel, compared with the swing plow, it appears to me to be principally, if not fully, explained by the more uniform horizontal motion communicated to the share and sole of the former through the regulating medium of the wheels at the fore part of the beam, which diminish the shocks arising from the continued vibrations of the implement when balanced between the hand of the plowman and the back and shoulders of the horse. It is not contended that wheels so situated act the part of lessening the friction between the sole and the soil; but they keep the rubbing part more truly to its depth, and maintain its horizontal action more correctly; whereas the horses affect a swing plow at every step by the irregularity of their proper movement, which has to be counteracted by the effort of the man at the opposite end. Thus conflicting forces are momentarily produced, and continual elevations and depressions of the point of the share take place, together with deviations from the flat position of the sole, which should be retained at right angles to the perpendicular; and to remedy which unskillful plowmen bear unequally on the stilts, which produces a lateral pressure landwards, and consequently a great amount of friction along the whole of the left side plane of the plow. However small may be the efforts of the plowman to keep his plow '*swimming fair*,' those efforts must be attended with increased resistance, and consequently with increased resistance to the horses."

It is not pretended that, in a wheel plow, none of these irregularities of motion exist; on the contrary, the dynamometer shows them to be very considerable, but less in degree than in the swing plow. The oscillations of the index of the dynamometer are, as

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might be expected, very great when applied to a plow. The point of a plowshare may be readily supposed, at one instant, to have burst a sod, which, opening and being raised upwards, offers for several inches but a trifling resistance to its progress; it again meets the obstacle, which is again overcome. It is similar with roots, stones and other varying impediments, and thus, at every step of the horse (whose motion is also a series of impulses), the draught, as exhibited by the dynamometer, is continually and largely varying.

These are effects arising from the nature of animal force and of the soil; they are necessarily common to both plows, but appear to be augmented in the swing, compared with the wheel plow, and sufficiently account for the diminished draught of the latter as shown in the experiments.

We think we have now shown that the claims of the advocates of swing plows are mostly invalid, while those of the friends of the wheel plow are shown to be founded in reason and experience, and the practice of American farmers is therefore fully justified.

Before leaving the subject we desire to quote a statement of Mr. Handley, which very strikingly illustrates the action of the plowman on the draught of the plow.

"In one of my trials I substituted for a first-rate plowman one who, though no novice, was decidedly his inferior, and who held the same plow for a *bout*, during which he exerted his best abilities, aware of the comparison about to be instituted, and yet the draught was in, his hands, increased *six per cent*, and I have no doubt, had he continued to hold the plow for an entire day, it would have been considerably more. This man, though inferior to the other, possessed skill above the average of plowman usually employed. Had he held a plow with wheels there would probably have been no difference in the draught between the holding of the plow by himself and predecessor."

There is a considerable difference in the mode of making and attaching wheels to plows. The old fashioned high gallows frame may be seen in Plate I. This plan, though capable of being used by a *good plowman* so as to do good work, is so complex in the adjustment that in the hands of unskilled workmen they are apt to consume more power and to do less perfect work.

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A much better and simpler plan for a *two* wheeled plow is given in Plate V, in connection with the plows of Messrs. Ransome and Howard. It is claimed by many that there is an advantage in the use of two wheels, as the land wheel acts as a lateral gauge to the width of each furrow as well as to the depth, and therefore the uniformity of width, depth and angle of the furrow slice thus produced give a perfect form to the whole operation. The American form of the double wheel plow is given in Fig. 83.

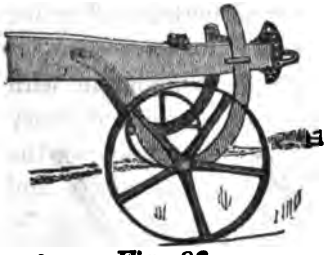

Fig. 83.

The usual form of the single wheel is shown on the side of the plow beam, in Fig. 84, and beneath it in Fig. 85. In either case the wheel frame is clasped to the beam in a manner that readily admits of raising or lowering the wheel to give the plow any desired depth of work; and when adjusted to a given point it is then made fast by tightening the clasp.

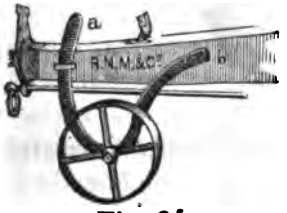

Fig. 84

Fig. 85.

THE COULTER.

Fig. 86 shows the manner of inserting the coulter through a mortise in the beam. It is secured by a wedge; the beam is strengthened from splitting by a diagonal band passing round it. It is adjusted to the *side* of the beam, as shown

Fig. 86.

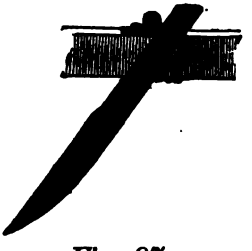

Fig. 87.

Fig. 88.

in Fig. 87, by a diagonal clamp, which supports the front of the coulter on the upper side, and the back on the lower side; the ends pass through holes in an iron plate, and are fastened securely by nuts.

Fig. 88 is a form of the coulter in which a circular plate,

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having a socket on its face, which secures the shank of the coulter; is made to revolve by the action of a screw, thus enabling the plowman to set it at any desired angle.

The favorite plans for raising or lowering the coulter in England are given in Fig. 89, and also for changing its angle, which will be readily understood on inspection.

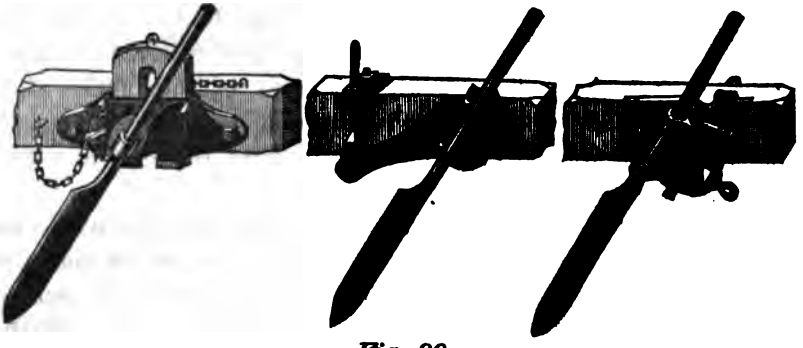

Fig. 89.

Fig. 90 represents the lock coulter, which is made of wrought iron, steel edged. It passes through the plow beam, and is made fast on top with a key, or with a nut and screw, and locks through the share and mould-board where they join together.

Fig. 90.

Fig. 91.

The adjustment is a very strong one, both for the coulter and the plow, and fits the implement for working among stones, stumps and roots, as the coulter cannot be turned out of place or broken by such obstacles. The revolving coulter is represented in Fig. 91. It consists of a steel plate, revolving on an axis, and having a stem which is clasped to the beam, as shown in the cut. In some cases the coulter is conveniently replaced by the *fin share* represented in Fig. 92. It is used for plowing sod lands infested with roots and stumps or stones, where the sward cutter cannot be used without danger of getting bent or misplaced. It is also useful when plowing in stubble or coarse manure, serving to keep the plow from clogging at the standard. It separates the furrow slice from the unplowed land easier and more smoothly than it could be done by the breast of the plow. Much depends upon the form and size of

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the coulter and its adjustment. It should be made of iron, faced with steel, and of sufficient bulk to stand firmly in the position in which it is set for its work; not to bend either to the right hand or to the left. The most approved English coulters are about two and a half inches wide, and formed by the meeting of two curves, as in Fig. 89. The land side of the coulter should be flat, and the opposite side a gradual taper from the edge to the back. The thickness must be determined by the strength of the work it has to perform. American coulters are generally made either straight edged, as in Fig. 87, or slightly curved backward from the point. When secured, as shown in Fig. 89, it is kneed inward, so as to adjust it to the plane of the land side.

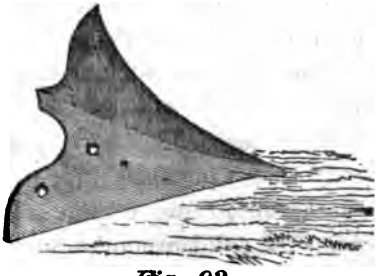

Fig. 92.

Having now considered the various forms of the coulter, we pass on to a consideration of its function and its adjustment.

Mr. Stephens has asserted that the force required to draw a coulter seven inches deep in the earth requires no more power than it does to draw a plow making a furrow seven inches deep and ten inches wide, without a coulter. This experiment, we believe, stands alone, unsupported by the testimony of any other observer. We had desired to verify it at Utica, with every precaution to insure accuracy, but were prevented from doing so by the unexpected and untimely removal of the dynamometer from thence.

The subject being one of such great importance, we give Mr. Stephens' statements in his own words:

"On a subject which has of late attracted considerable attention, I was desirous of obtaining information from experiments alone on the actual implement; and, to attain this more fully, I determined on analyzing the resistance as far as possible. With this view, a plow was prepared whose coulter was descended seven inches below the line of the sole, and fitted to stand at any required angle. This plow, with its sole upon the surface of a two-year old lea, and the coulter alone in the *soil*, the bridle having been adjusted to make it swim without any undue tendency, the force required to draw this experimental instrument, as indicated by the dynamometer, was twenty-six imperial stones (359

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pounds), and *no sensible difference was observed* in a range of angles varying from 45 to 70 degrees. This coulter, having been removed, the plow was drawn along the surface of the field, when the plow indicated eight stones (112 pounds), the usual draught of a plow on the surface.

"Another well-trimmed plow was at work in the same ridge, taking a furrow ten by seven inches, and its draught was also 350 pounds. The furrow thus taken produced, of course, a slice of very rough plowmanship; and though it exhibited, by a negative, the essential use of the coulter—the clean cutting of the slice from the solid ground—the whole question of the operation and working effects of the coulter are thus placed in a very anomolous position."

If the experiment of Mr. Stephens is reliable, it would seem that the extreme care which plowmakers have taken to adjust the coulter accurately to the various parts of the plow is quite unnecessary, and that the reasons given for their respective plans rest upon a purely imaginary foundation.

Farmers having observed that a drawing cut requires less power to separate a solid body than a direct cut by pressure—as the saw cuts easier than the chisel—have imagined that they obtained such a drawing cut by giving a long rake to the coulter; but on looking closely at the matter it will be seen that this gives no drawing action whatever to the cut of the coulter.

There is no upward and downward motion, no reciprocating action as when we draw a knife across a loaf of bread, but it is simply a cut effected by horizontal pressure operating through the whole length of the blade just as when the edge of a chisel is pressed into wood by the blow of a mallett. There is therefore no economy of power by inserting the coulter at a high angle with the sole, the resistance so far as the *splitting of homogeneous earth* is concerned is precisely the same whether the angle is 45 deg. or 80 deg.

Nevertheless, in practice, arising from *other causes* than the splitting of the earth, there are great advantages to be derived from a variation of the angle between 45 deg. and 85 deg., and incidentally there is a considerable saving of power.

Thus in plowing stubble land which is very foul the dry grass and butts of the straw would collect transversely on the edge of the coulter. In this case the draft is frequently increased by 150 pounds; by giving it it a long rake the stubble is shoved upward

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and the edge is kept clear. So when the ground is full of roots, when the coulter is set slanting the roots will slide upward, and the drawing action will cut them; whereas, if the coulter was set at 80 deg. it would draw them out. On the other hand, when used for plowing sod or clover the furrow will be much cleaner when the angle is 75 deg. or 80 deg., as it will not press the grass and roots upwards before they can be cut through.

There is one rule pretty generally observed in relation to the coulter, both in Europe and America, which is that the land side face shall always be parallel to the plane of the land side of the plow.

Another rule pretty generally adopted is that at the point where the coulter meets the surface of the ground the edge should stand about one-quarter of an inch landward of the plane of the land-side of the plow.

In the plows made by Prouty & Mears, and those of some other makers, the reverse of this rule is adopted, the coulter being set inwards toward the mould-board about half an inch at the point where the coulter touches the surface, as shown in Fig. 93, and extending from thence landward so that the point of the coulter is vertical over the point of the share. This leaves a small triangle whose base is half an inch and whose altitude is the depth of the furrow to cut off by the shin of the plow; this is converted into powder, which rolls over on the face of the furrow slice and covers the grass, which sometimes sticks up in the angle of the slice.

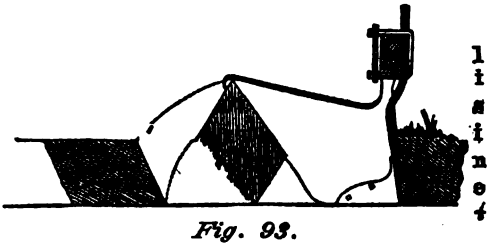

Fig. 93.

The vertical elevation of the point of the coulter above the plane of the sole is not well settled. In England it is generally put from one to two inches above, in America from three to four inches above it.

Then English and Scotch usually put the point of the coulter vertically over the point of the share, but in America it is placed mostly from two to four inches in advance of it.

We think there is no absolute rule which can be laid down upon these points. The nature of the soil to be plowed will influence the set of the coulter very considerably, and the determination of this part of the trimming of the plow may be safely left to the judgment of the plowman.

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CHAPTER IX

OF THE MECHANICAL CONDITIONS OF THE PLOW.

In order to fulfill the indications described in the preceding pages, it is necessary to form the plow so that, in sandy land, or in light crumbly loams, the furrow shall be completely inverted, so that the surface of the soil shall be laid upon the bottom, and that which was upon the bottom shall be turned upon the top.

In stiffer soils it is necessary to lap the furrows, so that the upper surface shall form an angle of 45 degrees with the base, when the lower edge of the last plowed slice will lap over one-third of the preceding slice.

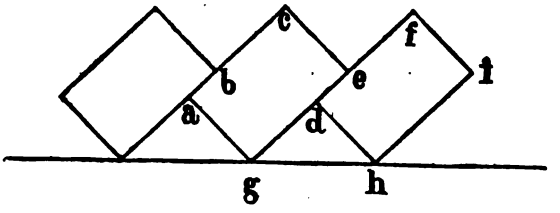

Fig. 94.

As will be seen on Fig. 94, where the lines *a c* and *d f* are nine inches long, and the lines *a g* and *d h* are six inches long, and the lines *a b* and *d e* are each three inches long, or one-third of the length of the lines *a c* and *d e*, which represent the breadth of the furrow. When the furrow slices are laid in this position, the line *b c* is always equal to the line *c e*, and the line *e f* to *f i*.

It may be shown by the following reasoning which we borrow from Mr. Stephens, that this position insures the exposure of the greatest possible surface of earth to the atmosphere. It also elevates the maximum cubical mass of earth, and makes the deepest seed-bed when the angles are drawn off by the action of the harrow.

Let *a b*, Fig. 95, represent the breadth of a ten-inch furrow slice, and describe the semicircle, *a c b*, upon it as a diameter. From this well known property of the circle, that the angle in a semicircle is a right angle, every triangle formed upon the diameter as a base, will be right angled; and the only isosceles triangle that can be formed within it will be that which has, *c d*

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equal *a b*, the breadth of the slice, which must always be equal to the distance between the apices of two contiguous furrows.

Complete the parallelogram, *a c d e*, which will represent the transverse section of a rectangular slice, whose breadth is ten inches, and whose two exposed faces, *a c* and *c b*, lie at angles of 45 degrees, and their breadth, as well as the area of the triangle, *a b c*, will be a maximum. In order to prove this, let a section of another slice be formed, whose exposed side, *a f*, shall be *greater* than the corresponding side, *a c*, of the former, and let this be taken at eight inches. From *f*, through the point *b*, draw

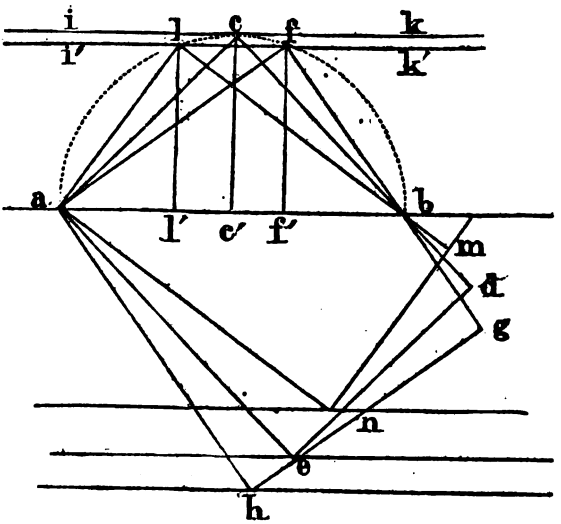

Fig. 95.

f g; then will *a f b* be a right angle as before; *f g*, being also made equal to ten inches, complete the parallelogram, *a f g h*, which will represent the transverse section of a rectangular slice ten inches by eight inches, occupying the same horizontal breadth as before, and whose exposed faces will be *a f* and *f b*. Draw the line *i c k* parallel to *a b*, and passing through the apex, *c*, of the triangle, *a c b;* and the line *i k*, also parallel to the line, *a b*, passing through the apex, *f*, of the triangle, *a f b*. Here the triangles, *a c b* and *a f b*, stand on equal bases, *a b;* but the first lies between the parallels *a b* and *i c k*, and the second between those of *a b* and *i' k';* the altitude, *f f'*, therefore, of the triangle *a f b* is less than the altitude, *c c'*, of the triangle, *a c b*. And triangles on equal bases being proportioned to their altitudes, it follows that the triangle *a f b* is less than the triangle *a c b*, both

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in area and periphery. Suppose, again, a slice whose sides, $a\ l$, is *less* than the corresponding side, $a\ c$, and let it be six inches; from l through the point b, as before, draw $l\ m$, and construct the parallelogram, $a\ l\ m\ n$, we shall have a transverse section of a third slice of ten by six inches, whose exposed faces, $a\ l$, $l\ b$, occupy the same horizontal breadth as before. Here the triangle $a\ l\ b$ lies between the parallels $a\ b$ and $i'\ k'$, consequently to $a\ f\ b$, and less than $a\ c\ b$.

This simple geometrical demonstration as applicable to the slice may be corroborated by the usual formula of the triangle. Thus the altitude of the triangle $a\ c\ b$ is $\frac{a\ b}{2} = 5$ inches $= c\ c'$, and the side $a\ c$ or $c\ b$ is $= \sqrt{a\ c^2 + c\ c^2}$; or $a\ c$ and $c\ c$ being each equal to five inches, $a\ c$ or $c\ b$ will $= \sqrt{25 + 25} = 7 \cdot 071$ inches, which is the depth due to a slice of ten inches in breadth, and the sum of the two exposed faces will be $7 \cdot 071 + 2 = 14 \cdot 142$ inches.

In the triangle $a\ f\ b$, $a\ b = 10$ inches, and $a\ f = 8$ inches, then $a\ b^2 - a\ f^2 = f\ b^2$, and the $\sqrt{f\ b^2} = 6$ inches. The three sides, therefore, of this triangle are ten, eight and six inches, and the altitude, $f\ f'$, is easily found by the principles of similar triangles. Thus, in the similar triangles, $a\ f\ f'$, $f\ b\ f'$, $a\ b : a\ f :: f\ b : f\ f'$. The perpendicular $f\ f'$ is therefore $= 4 \cdot 8$ inches, hence the exposed surfaces are as $14 \cdot 141 : 14$, and the altitudes as 5 to $4 \cdot 8$.

Since it turns out that $a\ l$ is equal to $f\ b$, and $a\ b$ is common to both, it follows that $l\ b$ is equal to $a\ f$, and the periphery and altitude is also equal and *less* in all respects than the triangle $a\ c\ b$, and so of any other position or dimension.

By recurring to Fig. 94, it will be seen that when the furrow slices are laid at an angle of 45 degrees, a triangular drain, $g\ d\ h$, is left under each furrow. This not only drains off the surface water, but allows the air to enter freely beneath the surface, which, in conformity with what has been said in the preceding section, is of very great advantage, and strongly recommends the adoption of this mode of plowing in stiff and retentive soils.

It will follow, from what has been stated, that the proportion of the depth to the width must always be in the ratio of 2 to 3. Six inches deep and nine inches broad, or seven inches by ten, are the most usual proportions.

Fig. 96 illustrates the action of the plow in this style of plowing; $a\ b$ is the exterior edge of the slice which is being turned; $e\ f$ is the edge along which the land side of the plow has just

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passed; *c d* is the inner edge of the slice; *g h* is the sole of the furrows, and *i k*, *l m* are slices which have been previously turned over.

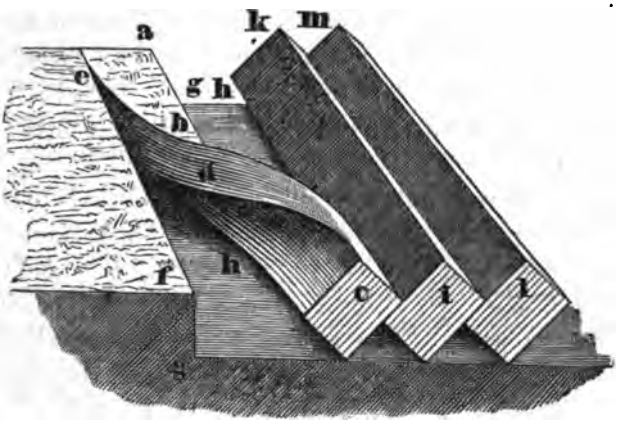

Fig. 96.

The exact mechanism of the rotation of the slice is clearly illustrated in Fig. 97. Let *a b c d* represent the transverse section of a furrow slice nine inches wide and six inches deep, which it is proposed to raise. The point of the plow enters at the point *d;* as nothing is cut or broken before it, it must necessarily take a greater strain and sustain a greater amount of abrasion than any other portion of the implement. The entrance of the point gives an upward tension to the slice, which facilitates the action of the

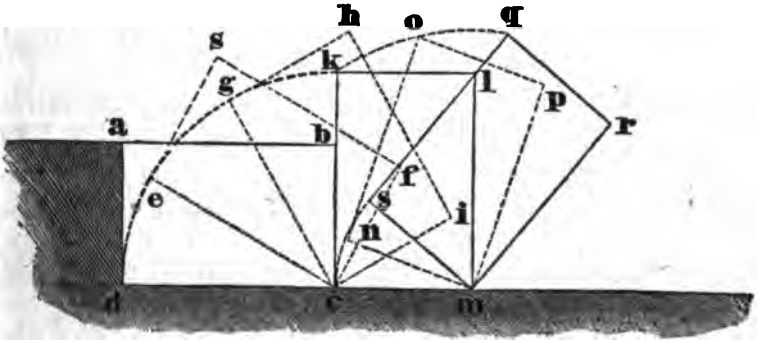

Fig. 97.

horizontally cutting edge of the feather, which severs the slice at the bottom from the sole, *d c*, as it advances forward; at the same time the slice is raised from its centre, *c*, and the outer and under corners traverses the arc of a circle, *d e g k*. The parallelogram, *c e s f*, shows the position of the slice when the point *d* has been

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vertically elevated four inches to the point *e*. At the point *g* it has been vertically elevated eight inches, and the position of the slice is shown in the parallelogram *c g h i*. When the point *d* has been raised through an entire quadrant, the line *d c* is represented by *k c*, and the line *b c* by *c m*. The vertical line of the mould-board in contact with the line *k c* is called the *zero* line, and the point touched by the angle at *k* is called the *zero* point. This point is of importance, as from it all measurements of plows are usually made. Up to this time the slice has turned on the centre *c*, but on its further passage to the positions *o p n m* and *q r m s*, the centre of rotation is the point *m*, until it attains to an angle of 45 degrees, when the slice rests upon the edge of the preceding furrow. If the whole sole of the slice were to be severed by the share, it is clear that it would be very difficult, if not impossible, to lay the slice accurately. The plow would act as a simple wedge, pushing the slice over to the furrow side from the land side; it would not coincide with the twist of the mould-board, and therefore the transverse cracks which it receives, and which is so essential to its pulverization, would not be communicated to it; it would frequently leave it in a vertical position, and sometimes, especially on side-hills, the furrow would fall back into its old position. To prevent this, the rear angle of the feather should never be further from the plane of the land side than from one-half to three-quarters of the breadth of the furrow, that is, if the furrow is ten inches wide, the rear angle of the feather should be from five to seven and one-half inches from the plane of the land side, measuring across the sole of the plow by the shortest line between them. The strip thus left unsevered on the furrow side holds the furrow to its place and forms a sort of hinge upon which it turns.

We have hitherto confined our attention exclusively to furrow slices whose transverse sections are rectangles; but many plow-makers and plowmen insist that a crested furrow, whose transverse section is a trapezoid, is better than the rectangular furrow because it forms a deeper seed-bed. This form is produced when the rear angle of the feather lies in a plane from one inch to an inch and a quarter higher than the plane of the point.

Fig. 98 shows that those who claim a better seed-bed for a trapezoidal furrow are mistaken. A series of triangles, *f g f'* and *f' g' f''*, etc., are left undisturbed at the bottom of the furrow, which are effectually cut up by a plow turning a rectangular

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furrow slice. Again, the side *a b* being nine inches, and the side *c d* a fraction longer; the side *b d* six inches, and the side *a c* four and a half inches, it is evident that less loose earth is provided for the seed-bed by a trapezoidal slice than a rectangular one by the triangle, *d e c*, which varies from one-seventh to one-tenth of the entire section, according to the elevation of the rear angle of the feather.

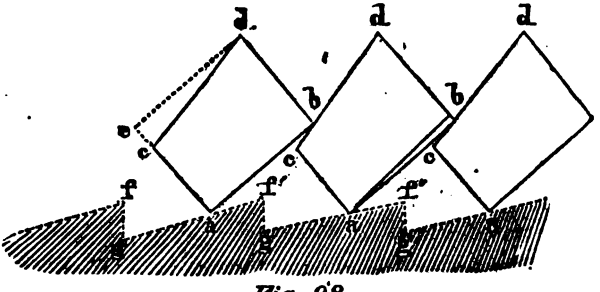

Fig. 98.

The practical rule proposed by Mr. Stephens for the formation of the sole of the plow, with reference to the formation of rectangular furrow slices, is that the height of the shield—the surface of the share—on the land side, opposite to the rear angle of the feather, be two and a half inches above the line of the sole shoe; that the share be one-half an inch below the line of the sole shoe, and not exceeding one-half an inch to landward of the land side plane; and that no part of the edge of the feather should be more than three-eighths of an inch above the plane of the sole shoe, that plane being always understood to be at right angles to the land side plane.

Another style of plowing, known as *sod and subsoil plowing*, which was introduced into this country about the year 1850, has worked its way very largely into public favor, and is probably destined to receive a still greater popularity as time continues to reveal its merits.

Fig. 99 shows the manner in which the work is performed. A skim plow is attached to the fore part of the beam, by clamps, which turns over from two to three inches, *a*, of the sod, depositing it, with the grass downward, on the sole of the preceding furrow, *c*. A larger plow, attached to the rear of the beam, follows and turns over the rest of the furrow, *b*, depositing it, in a finely pulverized condition, on the top of the first or sod furrow. In this way the grass and weeds on the surface are effectually buried,

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and are placed in a position to nourish the roots of the crop at the precise period when nourishment is most needed for maturing the crop. This kind of plowing prepares sod-ground for corn in the best possible manner.

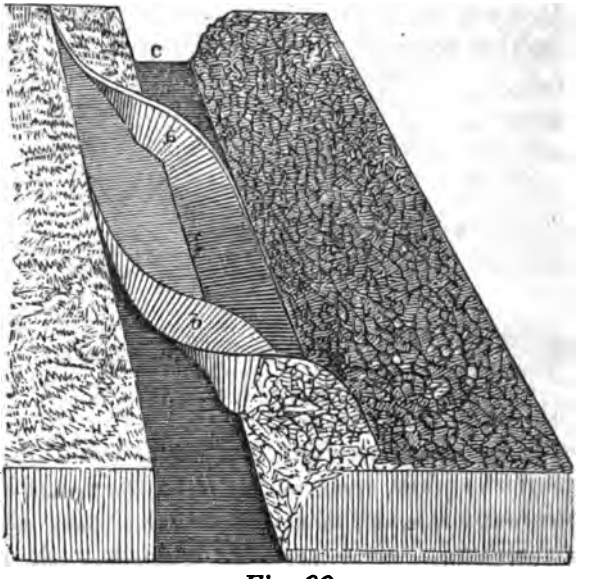

Fig. 99.

For land which is too bushy or too rooty with wild or swamp grasses, or where it is so sandy or mellow that pulverization is not an object, a third style of plowing is adopted which requires a special form of the plow.

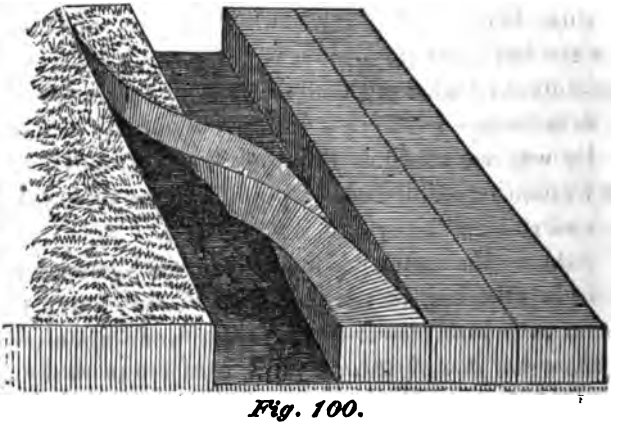

Fig. 100.

The action and movement of the furrow slice for *flat furrow sod plowing* is shown in Fig. 100, and requires no other explanation.

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The fourth kind of plowing is in stubble or old land, and is generally called *stubble plowing*. Fig. 101 represents this style

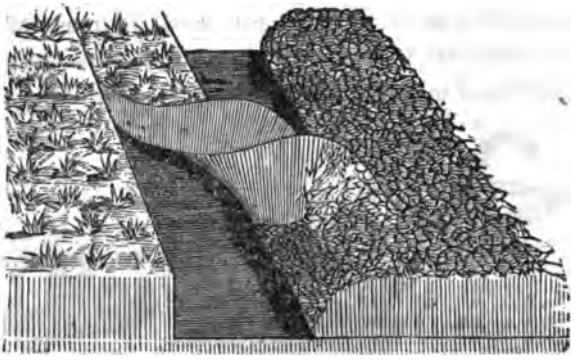

Fig. 101.

of plowing. The twist of the furrow is more sharp and decided than in sod plowing, as the soil is less compact, and can be pulverized with less expenditure of power.

Many side-hills which are fertile, are yet so steep that a furrow cannot be turned up hill, and must therefore be turned down hill. This requires a plow which shall permit the share and mould-board to swing alternately to the right and left of the land side.

Since mowing machines have been used as a substitute for the scythe, a demand has arisen for a more level culture, dispensing with open furrows and every other form of surface obstruction. The swivel plow being adapted to meet this want, its use has been greatly extended, and few farmers now feel that they can dispense with them.

There are other kinds of plows, but these five are sufficient for the cultivation of the land, and no good farmer can afford to dispense with them.

Mr. Holbrook has made an effort to dispense with so great a number by adapting to his sod plows a mould-board for stubble plowing, and a skim plow, when desired, for sod and subsoil plowing; and he has thus undoubtedly greatly increased the range of usefulness of each plow. Still it is impossible to ignore the fact that each plow can only do *perfect* work when taking the exact depth and width of furrow for which it was designed, and in exact proportion to its recession from this standard does it depart from perfect work. Such being the fact, we hope to see a very considerable increase in the number of plows owned by each farmer, which will enable them to do much better work in

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all positions, and to grow a much larger crop upon an acre than they have ever done before.

Before entering upon a consideration of the parts of a plow in detail, it is desirable to define those parts with accuracy, so that all ambiguity and misapprehension may be avoided.

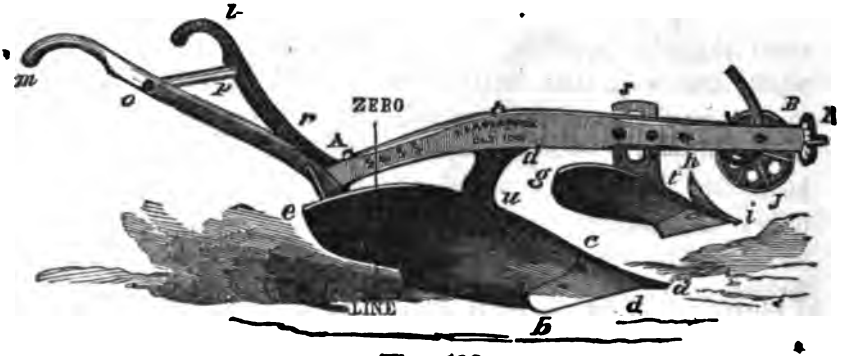

Fig. 102.

Fig. 102 represents Mr. Holbrook's Sod and Subsoil Plow. A B is the beam; *g i* the skim plow; *s t* its standard; *h i* its fin coulter; *j* the wheel; *k* the bridle; *a* the point of the plow; *a c b* the share; *b a'* the feather; *b* the rear angle of the feather; *a'* the front angle of the feather; *e u c v* the mould-board; *f v* the sole of the mould-board. The portion of the mould-board in contact with the furrow slice, at the instant that it assumes the vertical position, is called the zero line, and is marked on the figure. The portion of the mould-board in the rear of this zero line is called the wing of the mould-board; *d u* is the standard; *u c a* the line where the portion of the mould-board in front of the standard, which coincides with the land side, is called the shin. The curved portion of the plow, included in *u v a*, is the breast. The furrow side of the share is denominated the shield. The side of the figure towards the eye is the furrow side, and the opposite one is called the land side; *m* and *l* are the stilts or handles; *o p* and *q r* are the handle braces.

ON THE VARIOUS MEANS OF HOOKING TEAMS TO THE PLOW.

This is done by swing or swingle trees and bars, as they are called by some, or whiffle trees and eveners, as they are called by others. The length of the evener is generally three and a half feet; the length of the whiffle tree, between the hooks of the traces, is three feet, but these lengths are often considerably raised in order to meet special conditions.

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The strain upon a whiffle tree when used in plowing is analogous to that of a beam supported at both its ends and sustaining a load in the middle. The rule for estimating their strength is therefore the same in each case; and we know that the strength of beams is proportional to their breadths multiplied into the square of their depths and divided by their lengths. It is to be understood that the depth here expressed is that dimension of the whiffle tree which lies in the direction of the strain. It is used to express what the farmer would call the breadth of the whiffle tree. Suppose a whiffle tree three feet long between the trace hooks; its depth three inches, and its breadth one and a half inches, according to the rule given above, we have $\frac{1.5 \times 3^2}{3} = 4.5$, which, multiplied by the constant number 660 for oak, and 740 for ash, gives, in the one case, 2,970 pounds, and in the other 3,330 pounds, as the force that would break the whiffle tree. The same rule is applicable to the evener. The strength, thus found, is applicable only to the centre of the whiffle trees and evener, for it is obvious that the strain at the extremities is only half that at the centre. The ends may, therefore, be much less in depth than the centre, with perfect safety.

Wooden whiffle trees ought always to be fitted with clasp and eye mounting of the best wrought iron, from two to two and a half inches broad, about three-sixteenths of an inch thick in the middle parts, and worked off to a thin edge at the sides. The part forming the eye may range from one-half inch diameter in the centre eye of the large tree to three-eighths inch in the end clasps of the small trees; and they are applied to the wood in a hot state, which, by cooling, embraces the wood very firmly.

On the evener, the middle clasp has usually a ring or link welded into it, by which it is attached to the hook of the plow bridle. The two end clasps have their eyes on the opposite edge of the whiffle trees, with sufficient opening in the eyes to receive the (S) hooks of the whiffle trees and evener.

The mode of attaching two horses to a plow is so well understood by farmers that it is unnecessary to occupy any space in describing it.

Fig. 103 gives Mr. Stephens' mode of yoking three horses to the plow, which works very well in practice. In this figure, *a* is bridle of the plow; *b* the evener, five feet in length and of strength proportioned to the draught of three horses; *c d* and *e* are the three whiffle trees. The traces, though broken off in the

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figure at *f g*, are to be understood as extending forward to the shoulders of the horses. Between the evener and the whiffle trees the compensating apparatus is placed, as seen in the figure, consisting of three levers, usually constructed of iron. Two of these, *h i* and *h i*, are levers of the first order, but with unequal arms; the fulcrum, *k*, being fixed at one-third of the entire length

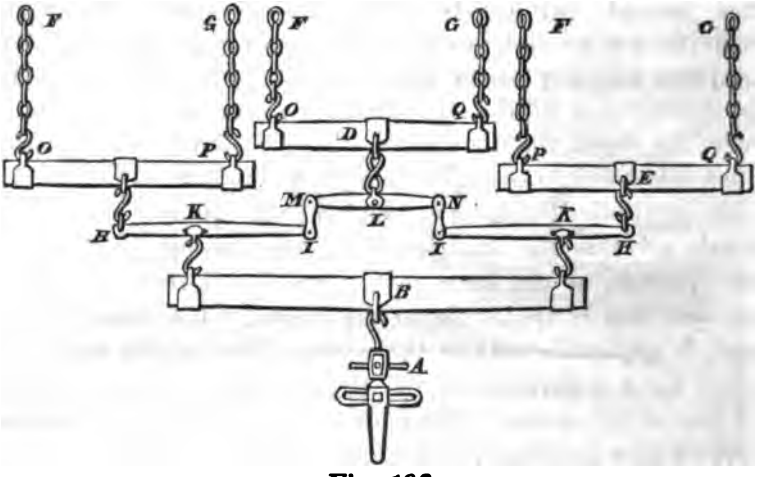

Fig. 103.

from the outward end of each. The arms of these levers are, therefore, in the proportion of two to one, and the entire length of each between the points of attachment is twenty-seven inches. A connecting lever, *l*, of equal arms, and twenty inches in length, is jointed to the longer arms, *i i*, of the former, by means of the double short links, *m n*. The two levers, *h i*, *h i*, are hooked by means of their shackles at *k* to the evener, *b*. From the mechanical arrangement of these levers, if the whole resistance at *a* be taken at 600 pounds, *k* and *k* will each require an exertion of 300 pounds to overcome the resistance. But these two forces fall to be subdivided in the proportion of the arms of the levers *h i*; two-thirds of each, or 200 pounds, being allotted to the arms, *h*, and the remaining one-third, 100 pounds, to the arms, *i*, which brings the system to an equilibrium. The two forces, *i i*, being conjoined by means of the connecting levers *m n*, their union produces a force of 200 pounds, thus equalizing the three ultimate forces, *h l h*, to 200 pounds each, and these three combined are equal to the whole resistance, *a*; and the three horses that are yoked to the whiffle trees, *c d e*, are subjected to equal exertion,

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whatever may be the amount of resistance at *a*, which has to be overcome.

The method of attaching three horses to the plow, most usual in the State of New York, is shown in Fig. 104. In this case the length of the whiffle trees is twenty-four inches; the secondary evener is thirty inches, and the principal evener is forty-five inches; in each case measuring between the draft-hooks. This brings the horses very near together, but they cannot much exceed this length if one of the horses walks in the furrow. In

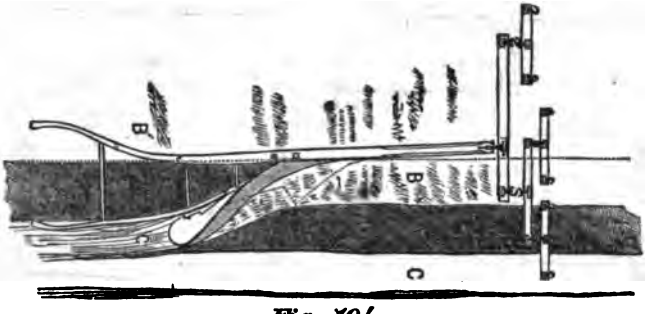

Fig. 104.

case the two horses are on the right hand and the one horse on the left, the clasp-ring or hook which is attached to the plow must be placed exactly at one-third of the distance between the two hooks at each end of the principal evener, that is, fifteen inches from the right hook; if the two horses are placed at the left hand, then the distance must be reversed. In this case, as before, each horse will pull exactly one-third of the load, for, as the left-hand lever is just twice as long as the right-hand lever, this last will take just twice as much power to draw it. If the total draught of the plow is 600 pounds, the left horse will pull one-third of it (200 pounds) and the two right-hand horses will pull 400 pounds; the secondary evener being a lever having equal arms, the load on each horse will be just half that amount—200 pounds. If the nigh horse is heavier and stronger than the other two, it will be still more convenient, as the long side of the evener may then be somewhat shortened so as to enable the horse to walk more easily in the furrow.

When it is desired to attach four horses to the plow, it is usually done by placing them two-and-two, one pair before the other, the evener of the forward pair being connected with the evener of the hinder pair by a long-chain called a soam-chain. The horses next to the plow are connected by a neck-yoke, through

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the ring of which the neck-yoke runs. It is an objection to this method, that both teams are not obliged to do their fair equal share of the work.

The plan recommended by Mr. Stephens obviates this difficulty, and compels each horse to take his proper proportion of the load.

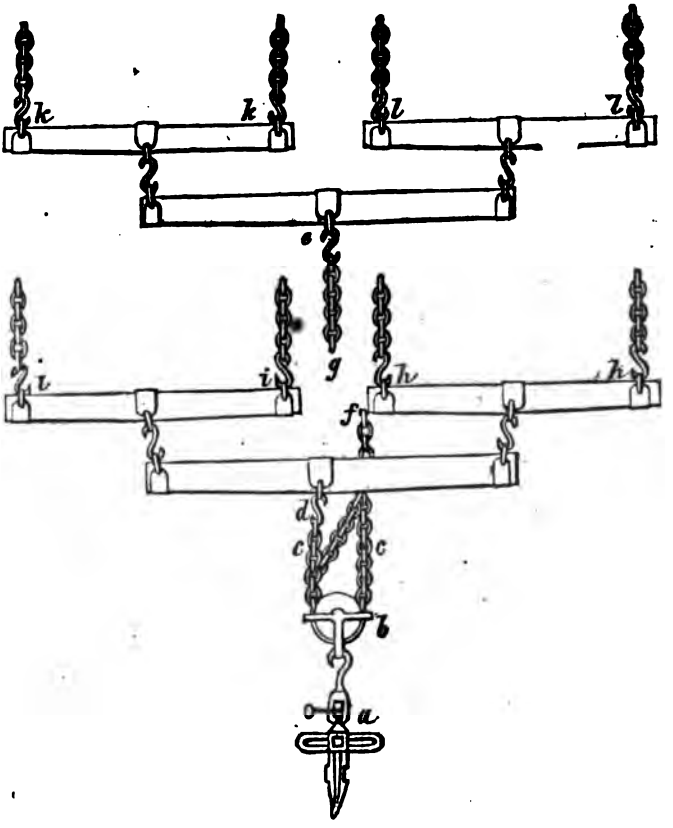

Fig. 105.

It is represented in Fig. 105, where *a* is the bridle of the plow, with its swivel hook. A pully, *b*, of cast iron, six inches in diameter, mounted in an iron frame, of which an edge view is given in *m*, is attached to the hook of the bridle. A link-chain, *c*, is rove through the frame of the pulley, and to one end of it the short end is hooked; the evener, *d*, is hooked to a set of whiffle trees for the plow horses. The other end of the chain passes forward to a sufficient distance to allow the leading horses room to work, and to it is hooked the second evener at *e*, for the leaders. In the figure, a part of the chain, from *f* to *g*, is broken off; but the full length is about eleven feet. In this arrangement the

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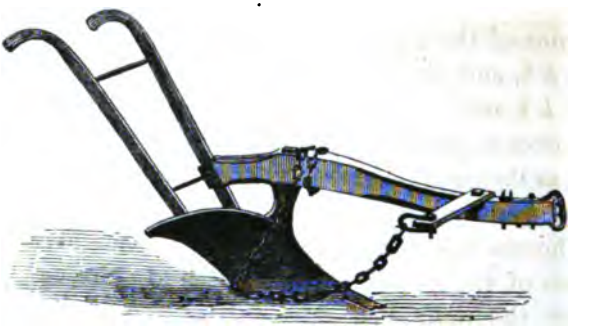

Fig. 106.

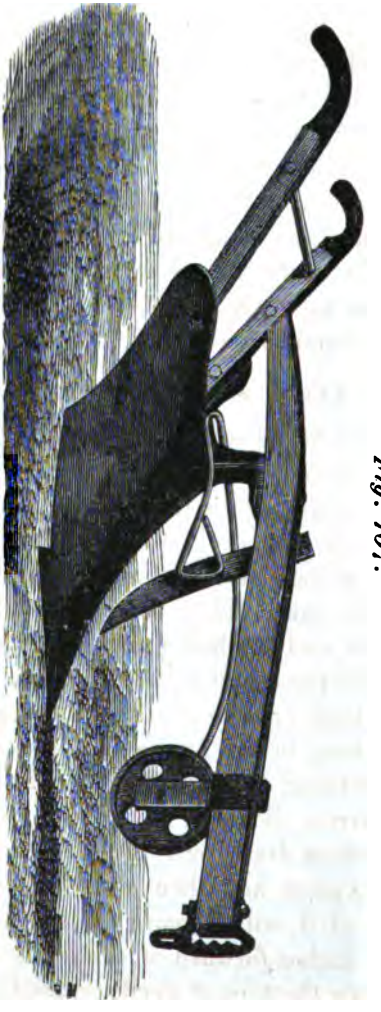

Fig. 108.

Fig. 107.

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trace-chains of the nigh-side hind horse are hooked to the whiffle trees at *h h*, and those of the off-side horse at *i i;* the leaders being at *k k* and *l l* respectively. In this arrangement the balance of the forces is perfectly preserved; for the hind horses and the leaders, as they pull at opposing ends of the chain passing round a pulley, which must inevitably be always in equilibrium, each pair of horses has an equal share of the draught; and, from the principles of the evener and whiffle trees, through which each pair acts, the individual horses must have an equally perfect division of the labor, unless this equilibrium has been removed for the purpose of easing a weaker horse. In order to prevent either the hind horses or the leaders from slipping too much ahead, it is common to apply a light check-chain, *o*, of about fifteen inches long, connecting the two parts of the main chains, so as to allow only a short oscillation round the pulley, which is limited by the check chain. When this is adopted, care should be taken never to allow the check-chain to remain upon the stretch; for if it does so, the advantage of equalization is lost, and it becomes no better than a simple soam-chain. In all cases of using a chain, that part of it which passes forward between the hind horses must be borne up by means of a neck-yoke or other attachments to their back-bands or collars.

ADJUSTMENTS FOR PLOWING UNDER WEEDS AND STUBBLE.

Those who have plowed land infested with long weeds, bushes and tall corn stubble, well know how difficult it is to make good work and bring the surface growth beneath the plowed ground. Fig. 106 shows a ready and effective means of accomplishing this object. This plan consists of a log-chain, or large tarred rope, having one end attached to the outer end of the whiffle tree of the off-side horse, and the other end hitched round the beam of the plow, near the standard, as represented by the Fig. 106. The chain should always be only long enough to draw the tops of whatever is being plowed in along in the furrow, just in time to allow the furrow slice, when turning, to fall on it. If the chain is a few inches too long, the furrow slice will fall upon it, and be broken and displaced as the chain draws out. Take a "rolling hitch" around the beam of the plow, and then adjust the length of the chain until the bight of it will remain on the turning furrow slice, only two or three inches forward of the point where it comes to rest. This will draw the tops of weeds, grass, Canada

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thistles, and corn-stalks, completely beneath the falling earth; whereas, without such a contrivance, the tops would extend above ground, and if not already matured, would continue to grow, sometimes quite as well as if they had not been plowed in. Sometimes weeds and corn-stalks are first mowed close to the ground, and hauled into the furrows, as the plowing is in progress. But, in this practice, the green material is not distributed as evenly as it is when plowed in without being mowed. A piece of half-inch round iron, bent in the form of a letter U is used instead of a chain for drawing under red clover or other crops. But, as a chain is more flexible than an iron bow, it has been found more convenient. When the plow is drawn by oxen, the chain is attached to a stick about twenty inches long, bolted to the upper side of the beam, as shown by the preceding engraving. If hitched to the forward end of the plow beam, the chain will not always run far enough to the right side of the furrow to draw in the tops of all the stalks. However, if the chain is adjusted correctly as to length, the work can be performed quite satisfactorily.

Plowmen experience some difficulty in keeping the bight of the chain back in its proper place on the turning furrow slice. For this reason they are not able to draw everything under the slices, as is desirable. To obviate this difficulty, J. & A. Kilmer have invented the arrangement shown in Fig. 107. The attachment in question is merely a chain, A, connected to the plow beam and the double whiffle tree, and provided with a rod, B, which is called a "regulator" by the inventor. This regulator makes a bight or loop in the chain, so that the matter desired to plow under is caught by it and diverted toward the furrow, into which it is thrown and covered.

DEVICES FOR CLEARING THE COULTER.

In using the ordinary plow, especially on stubble fields, or in heavy grass land, the angle between the coulter and beam frequently becomes choked to such an extent as to raise the share from its proper depth, and necessitate stopping the team and removing the obstacle by hand. In the accompanying engraving there is represented a very simple contrivance designed to remedy this difficulty. (See Fig. 108.)

In the guide wheel is placed a stud or pin which forms a crank, and to this pin is pivoted the end of a rod of iron, which is carried

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along under the beam and around the lug of the share to the coulter, as seen in the engraving. As the guide wheel rotates a reciprocating with a vertical motion is given to this vibrating rod, so that as the rod advances to the front of the coulter edge it pushes the stubble from the blade and throws it down into the furrow.

LEFT HAND PLOWS.

In some parts of the country left hand plows are very much in vogue. The team is generally driven with a single line. In Fig. 109 we give an illustration of the mode of driving.

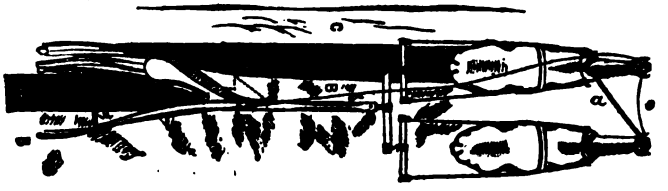

Fig. 109.

In this case the nigh horse walks in the furrow, and the single line is attached to his bridle. The off horse is guided by a "jockey stick," *a*, from the hames ring of the nigh horse, and by strap *c* between their heads.

PLOWING GROUNDS WITHOUT DEAD FURROWS.

It is sometimes very desirable to do this; we therefore give the annexed method of accomplishing it, taken from the "American Agriculturalist."

PLOWING GROUND WITHOUT DEAD FURROWS.

Dead furrows are a nuisance, especially where hoed crops are cultivated; and when land is stocked down for meadows, deep dead furrows make an uneven surface for the mowers and horse-rakes to work over. When a field is plowed in lands beginning on the outside, turning all the furrows outward, and finishing the plowing in the middle of the field, there will be a dead furrow from every corner to the middle dead furrow of each land, and a strip of ground eight or ten feet wide on one side of every dead furrow will be trodden down firmly by the teams when turning around. Plowing a field without dead fur-

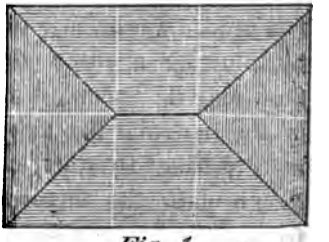

Fig. 1.

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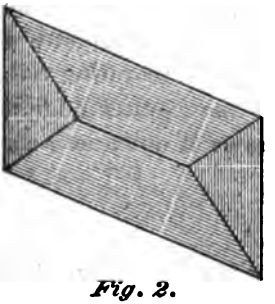

Fig. 2.

rows is simply commencing at the middle and turning the furrow slices all inward. If the plowing be done with a right hand plow the teams will "gee around," always turning on the unplowed ground. When a field is plowed in this manner there are no ridges or dead furrows, and the surface is even, so that the operation of any machine is never hindered. When sod ground is plowed in lands there is always a strip of ground beneath the first two furrow slices at every ridge that is not broken up. This is to a great extent avoided when the whole field is plowed as one land, and may be entirely avoided if back-furrowed. The accompanying diagrams will show how to plow a square field, or one of irregular boundary, commencing in the middle and finishing at the outsides. Fig. 1 shows a rectangular field. The plowman finds a point equally distant from three sides, measuring of course at right angles to the sides, and sets a stake. Then he finds the point equally distant from the three sides at the other end, and sets another stake. From these two stakes to the corners of the field he turns two furrow slices together, and then plows the field, being guided by them, and occasionally measuring to the outside to see if he is keeping his furrows of equal width at setting in and running out, and on each side. In Fig. 2, a four sided lot, where the angles are not right angles, precisely the same rule is followed. In the case of the triangular field, the plowman begins by plowing about a single point, which, though awkward at first, may be executed with ease after a few trials. In the case of the irregular five sided lot, represented by Fig. 4, it is a little more difficult to start exactly right, but the ruling gives a clear idea of how the furrows run, and it is always well to pace off frequently to the outside of the lot—or rather from the fence starting at right angles to it—to be sure that the portion remaining unplowed on each side, and at each end of each side, remains always of a corresponding width as the plowing progresses.

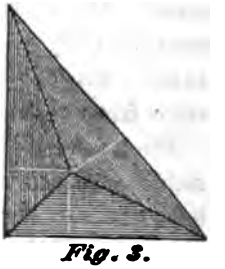

Fig. 3.

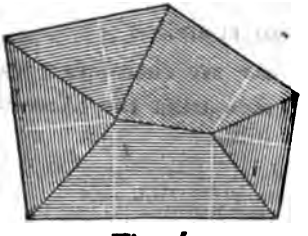

Fig. 4.

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CHAPTER X.

REPORT OF THE JUDGES

APPOINTED BY THE STATE AGRICULTURAL SOCIETY OF NEW YORK TO EXAMINE PLOWS, CULTIVATORS AND HARROWS.

HISTORY OF THE TRIAL.

The Society has for several years had it in contemplation to make a thorough trial of the various agricultural implements used for preparing the land for the growth of crops; for putting in the seed; for the distribution of manures, and for severing the crops from the soil, as well as preparing them for market.

Much delay occurred in prosecuting this design from its inability to procure instruments of sufficient accuracy for determining the actual results obtained in a satisfactory manner. These difficulties were finally overcome, and instruments were invented and manufactured for the purpose, mainly by Mr. Henry Waterman, of Hudson, the Consulting Engineer of the Society.

It was at first proposed to make a trial of all the implements in a single year, but it was soon found that this would involve so large an amount of labor, and occupy so much time, that it would be impossible to procure a board of judges who could spare the time from their own private pursuits to do justice to the work assigned to them.

It was, therefore, resolved to hold a trial of the implements for severing the crops from the ground and for preparing them for market in the year 1866, at Auburn, and the trial of plows, harrows and cultivators was fixed for the month of May, 1867.

Extensive correspondence was had with the leading manufacturers of these implements, after which the executive committee prepared a programme, which is given below, and appointed the following gentlemen to act as judges at the trial, viz:

JOHN STANTON GOULD, of Hudson, N. Y., Chairman; Prof. BENJAMIN PIERCE, Cambridge, Mass.; Hon. ELISHA R. POTTER, Kingston, R. I.; SANFORD HOWARD, Lansing, Michigan; HENRY WATERMAN, Hudson, N. Y.; PETER CRISPELL, Jr., Kingston, N. Y.; GEORGE GEDDES, Syracuse, N. Y.; ABRAHAM B. CONGER, Waldberg, Rockland county, N. Y.; JOSEPH MCGRAW, Jr., Dryden, N. Y.; B. P. JOHNSON, Albany, N. Y.

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NEW YORK STATE AGRICULTURAL SOCIETY.

Second National Trial of Plows and Other Implements, 1867

PROGRAMME FOR PLOWS.

The New York State Agricultural Society respectfully invite the makers of plows in any State of the Union, in Canada, and in Europe, to compete in the following enumeration of classes for the prizes annexed to each class:

A gold medal is offered by the New York State Agricultural Society for the best low in each of the following classes:

CLASS I.—A sod plow for stiff soils.

CLASS II.—A plow for stubble land in stiff soils.

CLASS III.—A sod plow for sandy soils and light loams.

CLASS IV.—A plow for stubble land, which will cut a furrow twelve inches deep, with three horses, which will raise the lowest soil to the surface of the furrow. For a plow which will turn a furrow of this kind not less than five inches wide, the Society offers as a prize its large gold medal.

CLASS V.—A Michigan sod and trench plow.

CLASS VI.—A subsoil plow in connection with an ordinary plow.

CLASS VII.—A ditching plow for opening drains.

CLASS VIII.—A machine for excavating ditches for under-draining.

CLASS IX.—A steel plow for alluvial and unctuous lands.

CLASS X.—A swing or side-hill plow.

ENTRIES.

§ 1. Competitors must enter their plows at the Secretary's office, Albany, at least two weeks before the time fixed for the commencement of the trial. This rule will be rigidly enforced, as it will otherwise be impossible to provide lots for the trial.

§ 2. At the time of making the entry each competitor will be required to file a statement showing, first, the price of the plow; second, its weight; third, the rule or the formation of the mould-board; fourth, a statement of the valuable points claimed by the exhibitor.

§ 3.

§ 4. Each plow will be numbered in the order of its entry. A card showing legibly this number and the number of its class must be affixed to each plow. If it is lost or the numbers be obliterated, new cards will be furnished by the Secretary. No judge will make any record respecting any plow unless this card is upon it. Without a strict adherence to this rule it will be impossible for the judges to keep their notes correctly.

§ 5. Every plow entered will be charged with a fee of twenty dollars.

§ 6. As soon as the time for making the entries has expired, the Secretary will cause them to be printed. A complete list of the entries, with the numbers and the statements required to be made, will be placed in the hands of each of the judges.

DUTIES OF OFFICERS.

The Officers of the Society will,

§ 1. Stake off a sufficient number of plots, each containing a quarter of an acre. A space two feet wide will be left between each plot.

§ 2. The stakes will be 2½ feet long by 2½ inches wide. The plots will be numbered from No. 1 upward. There will be four stakes to each lot, each of the four

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will bear the same number. The number of all the stakes will face inward toward the lot which they designate. The stakes will be rounded at one end and sharpened at the other.

§ 3. Eight poles will be provided, each eight feet long, they will be painted white downward two feet below the top, a black ring six inches wide will be painted in the middle of the whole field. Two swivel hooks.

Two hooks with their ends bent on opposite sides of the shank Four gauges to show the breadth of the furrow. One for ascertaining its depth One dynamometer. One platform scale of sufficient size for weighing plows. One tape line 200 feet long. One tape line eight feet long for each member of the descriptive committee. A two-foot carpenter's square. A bevel rule. A spirit level, and a blank book and pencil for each judge.

§ 4. They will procure a sufficient number of active and faithful policemen to keep all intruders from the plow ground, and to preserve order at the trial. A tent sufficiently large to shelter all the judges. A team for the special dynamometer trials, and a lumber wagon.

Duties of Competitors.

§ 1. Each competitor will furnish his own team and plowman. In the special dynamometer trials the team to be furnished by the Society.

§ 2. They will provide themselves with wrenches and other tools for taking the plows apart when necessary.

§ 3. The plots will be plowed in the order of their numbers. All competitors not ready for work when called on may be ruled out by the judges.

Duties of Judges.

§ 1. The chairman of the Board of Judges will, on the first day of the trial, distribute the plots of ground by lot among the competitors.

§ 2. The judges will commence operations each morning at eight o'clock, lunch at half past twelve o'clock, and finish at half past five o'clock. They are particularly requested to look over their minutes every evening, and if their notes are imperfect to remedy the deficiency as early as possible.

§ 3. Before entering upon his duties, each judge shall subscribe a written declaration that he is not directly or indirectly interested in the sale of any plow.

§ 4. The following will be examined as the most important points of the plow:

1. Pulverizing power.
2. Non-liability to choke in stubble.
3. Lightness of draught, considered in connection with pulverizing power.
4. Ease of holding.
5. Durability.
6. Cheapness.
7. Excellence of mechanical work.
8. Excellence of material.
9. Thorough inversion and burial of weeds.
10. Even distribution of wear.
11. Regularity or trueness of turning and carrying the furrow slice on sod.

§ 5. Lightness of draught *alone*, except in sandy lands, will not be esteemed a great merit. The plow which pulverizes the soil most, with the least draft, will have the preference.

§ 6. The Society desire to encourage an increased depth of plowing in the State. Those plows, therefore, that are able to turn a furrow in a satisfactory manner,

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so that the depth shall bear the greatest proportion to the width, will have the preference. The furrow will be laid as nearly as possible at an angle of forty-five degrees.

§ 7. The judges will be subdivided into committees, as follows.

(*a*) A Dynamometer Committee.

(*b*) A Description Committee.

(*c*) A Weight and Price Committee.

(*d*) A Time Committee.

(*e*) A Committee on Quality, Material and Mechanical Structure.

Each judge will form an opinion upon *each point* of the work of the plows and record it in his note book.

§ 8. The point of each plow will be detached before it begins to work and accurately weighed by the Weight and Price Committee. It will be weighed again as soon as its work is finished. It will be deemed a point of great merit in the plow that shows the least abrasion.

§ 9. Not more than four plows shall be at work at any one time, and one judge shall be assigned by the chairman to each plow. It shall be the duty of the judge so assigned to observe the action and work of the plow during the whole time that it is in operation. He will note the exact time occupied in plowing. If there are any stoppages he will note the exact time of the stoppage, and state exactly the cause of it. He will measure and record the length and breadth o each urrow slice three times on each furrow, the average of these to be taken as its true size.

§ 10. The dynamometer will be applied on two furrows, viz., going and returning on each lot. The length and depth of the furrow slice shall be measured six times on each furrow, when the dynamometer is applied. The judge in charge will also observe whether the sole of the plow is kept in a horizontal position; if it departs from this at any time it is to be noted; the instrument No. 2 will enable him to measure the amount of departure.

§ 11. In addition to the dynamometer trials on the respective lots, additional trials shall be made under the direction of the judges in some level field. Each plow shall plow one furrow without, and the next with the dynamometer attached, and so on until all have been tried. If desired, the judges may then try the draught by a windlass and hand power.

§ 12. After all of the plowing is finished, the judges will carefully and critically examine each lot. They will designate the different qualities of plowing by the numbers one up to ten. Ten indicates the best plowing, one the worst, and the other numbers the intervening degrees of merit. As the examination proceeds each judge will place in the book opposite to the number of the lot the number which, in his judgment, indicates the excellence of the plowing. The judges will then assemble privately, when the chairman will inquire of each judge successively what number indicating excellence he has affixed to No. 1. The chairman will record such numbers opposite to No. 1. He will then ask for the marks of each judge for lot No. 2, and so on until the merit marks of all the judges are ascertained and recorded. The plow used on the lot to which a majority of the judges assign the highest marks of merit shall have the preference for "excellence of work."

§ 13. The records of the dynamometer trials shall then be examined by the judges, and if they find that there is any very striking discrepancy between the different kinds of trial above mentioned they may cause the plows in which such discrepancy exists to be tried over until they are fully satisfied with respect to

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the draft of each. They will then determine the best plow for lightness of draught, which determination shall be recorded by the chairman.

§ 14. The plows shall then be examined with regard to wear, those being deemed best where the wear is most evenly distributed. The plows having the greatest number of votes shall be deemed the best in point of durability.

§ 15. The plows shall then be minutely examined with reference to the material of which they are composed (the quality of the wood and iron), and the best in this respect shall be recorded as "made of the best material."

The plow having the greatest number of suffrages shall be deemed the best for mechanical construction."

§ 16. Exhibitors will be required to present an ingot, cast in an iron mould, of the iron used in making the plow, at least one and a half inches thick. There must be an affidavit stating the furnace from which they obtain their pig-iron, and if more than one kind is used, the proportions of each kind used, and that the ingot is a fair sample of iron used in the plows.

§ 17. The judges will closely observe the furrow slice in the act of being turned and see if that action tends to open or compress it; they will also observe the force required to press the end of a stick into the furrow. If practicable the judges will not determine on the question of pulverization until they have had an opportunity of seeing the time that elapses before each lot dries after a fall of rain, and the growth of crops on each.

§ 18. The plow which is finally determined to have the greatest number of good points shall be awarded the first prize as the best plow.

§ 19. The judges shall in no case consult with each other or express opinions in presence of competitors.

§ 20. No person except judges and officers shall be permitted by the police to enter upon the plowed grounds.

§ 21. The judges will cause comparative experiments to be made to ascertain the influence of the coulter on draught; they will investigate experimentally the best angle for its insertion, and also the most advantageous depth for it.

§ 22. They will inquire into the effect of the wheel on draught.

§ 23. They will ascertain the influence of speed upon the draught of the plow.

§ 24. They will ascertain the effect of long and short beams.

§ 25. They will investigate the influence of weight on plows.

§ 26. They will ascertain the rate which the several parts of the plow consume power, as compared with the total draft, *i. e.* what proportion of the power is consumed in turning the furrow over? What proportion for overcoming the cohesion of the earth on the land side? On the bottom? How much of friction?

MISCELLANEOUS REGULATIONS.

§ 1. The plows for competition must be exactly as they are sold to the farmers, except that each competitor will be allowed to scour the working parts.

§ 2. Provision will be made by the Society for conveying the judges to and from the trial grounds. Lunch will also be provided for them.

§ 3. Notice will be given of the time and place of holding the trial as soon as it is determined on.

PROGRAMME FOR HARROWS.

§ 1. There will be but one class of these machines. A premium of a medal is offered for the best harrow.

§ 2. The general rules for the trial of plows will be followed in the trial of harrows, as far as they are applicable.

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§ 3. Harrows will be tried next in order after the trial of plows.

§ 4. The points to be determined respecting them are as follows:

1. Which combines strength with lightness in the highest degree?
2. Which combines the best materials with the best workmanship?
3. Which combines the greatest pulverizing power with the least draft?
4. Which is managed in the field with the greatest facility?
5. Which is least liable to clog in working?
6. Which works the most rapidly?

Persons desiring to enter articles for exhibition only will be permitted to do so on payment of five dollars.

PROGRAMME FOR CULTIVATORS.

The Society offer the following premiums for cultivators:

CLASS I.

For corn and root crops, best one-horse cultivator to cultivate one row, a gold medal.

For best two-horse cultivator for cultivating two rows, a gold medal.

CLASS II.

For mellowing soil and killing weeds, best cultivator on wheels, with device for raising and lowering the frame that holds the teeth, so as to regulate the depth of cultivation and to make the machine portable, a gold medal.

Best cultivator having handles to guide it, and with or without small wheels to regulate the depth of the cultivator, a gold medal.

The judges will carefully observe and express their opinion on each of the following points:

1. Thoroughness and depth of pulverization. It is desirable the instrument should work deep or shallow, as may be desired by the operator.
2. Adaptation to a variety of soil, such as sandy, stony, clayey, etc.
3. Facility of control by the driver; this includes steerage, turning corners, raising or lowering one or the other of the parts at the pleasure of the driver.
4. Comfort and convenience of the driver; this also includes his ability to see the rows distinctly.
5. Portability and convenience for storage.
6. Ability to resist clogging, not only by grass, roots, and other ligneous matters, but in damp soils.
7. Adaptation to side hills and uneven surfaces.
8. Adaptation to the greatest variety of purposes.
9. Durability.
10. Cheapness.

The instrument having the greatest number of merits and the fewest defects will be entitled to the prize. If, however, an instrument has many advantages, if it has one defect of great magnitude, it must be rejected.

The same implement may compete in both classes if desired, but it will pay a separate entry fee for each class.

The trial of cultivators will follow immediately after the trial of harrows.

Place of Trial—Near Utica, N. Y.

Time of Beginning—Tuesday, May 7th, 1867.

The judges will meet at Baggs' Hotel on Saturday, May 4th.

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The President, Secretary, Consulting Engineer, and Chairman of the Board of Judges, will assemble at Baggs' Hotel on Tuesday, April 30th, and will make all needful arrangements for the preparation of the ground and the reception of implements.

B. P. JOHNSON, *Secretary.*

State Agricultural Rooms, Albany, N. Y.

The judges and competitors were all assembled at Utica on the 7th of May, as appointed in the programme. The grounds were all staked on the farm of Mr. John Butterfield, who had generously offered it, with all needful facilities, to the Society; and every preparation was completed, but it had rained nearly every day for a week previous, the ground was thoroughly saturated with moisture, and it continued to rain for ten consecutive days after the 7th, the day appointed for the commencement of the trial. The land was, in consequence, like a mortar-bed, and was utterly unfit for a trial which would be satisfactory either to the Society or the competitors.

It was therefore resolved, after conference with all parties, and with their entire assent, to adjourn the trial until the 10th day of September, to be held at the same place.

At that time, the parties having reassembled, the trial was had in conformity with the programme. The following is the list of entries:

PLOWS.

Class I.

No. 16..... F. F. Holbrook..... Boston.

Class II.

No. 17..... F. F. Holbrook..... Boston.
No. 12..... Collins & Co..... New York.

Class III.

No. 1 ..... A. L. Brearley & Co..... Trenton, N. J
No. 18..... F. F. Holbrook..... ..... Boston.

Class IV.

No. 19..... F. F. Holbrook..... Boston.
No. 13..... Collins & Co..... New York.

Class V.

No. 20..... F. F. Holbrook..... Boston.

Class VI.

No. 6 ..... R. J. Wheatley..... Du Quoin.

Class VII.

No. 5..... A. P. Routt..... Somerset, Va.

Class VIII.

No. 23..... E. Heath..... Fowlerville, N. Y.

Class IX.

No. 14..... Collins & Co..... New York.

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CLASS X.

No. 21..... F. F. Holbrook..... Boston.
No. 27..... L. D. Burch..... Sherburne, N. Y.

On an examination of the preceding list of entries, it will be observed that the plows entered by F. F. Holbrook are more numerous than those of any other contributor, and that in fact they are represented in nearly every class. These plows are all constructed on a plan invented by Governor F. Holbrook, of Vermont, and now a professor of Agriculture in Cornell University.

We were instructed in the most minute details of this plow by Gov. Holbrook, and the trials at Utica and subsequently at Brattleboro showed very clearly the influence of the warped surface which is generated by his method upon the texture of the soil.

Governor Holbrook is as yet unprotected by a patent on his method, and we are therefore most reluctantly compelled to withhold a description of it, but we have no hesitation in saying that it is the best system for generating the true curves of the mould-board that has been brought to our knowledge. This method is applicable to the most diversified forms of the plow, to long or short, to broad or narrow, to high or low, no matter what the form may be, this method will impress a family likeness upon them all; there will be straight lines in each running from the front to the rear, and from the sole to the upper parts of the share and mould-board. None of these lines will be parallel to each other, nor will either of them be radii from a common centre. The angle formed by any two of them will be unlike the angle formed by any other two; a change in the angle formed by any of the transverse lines will produce a corresponding change in the vertical lines, and there will always, in every form of the plow, be a reciprocal relation between the transverse and vertical lines. Plows made upon this plan may appear to the eye to be as widely different as it is possible to make them, and yet, on the application of the straight-edge and protractor it will be found that they agree precisely in their fundamental character. The surface of the mould-board is always such that the different parts of the furrow slice will move over it with unequal velocities.

CLASS I.—SOD PLOWS FOR STIFF SOILS.

The only entry in this class was by F. F. Holbrook of his Lap Furrow Sod plow for stiff soils (No. 65). Weight, 130 pounds. Price, $20.

The soil was of a stiff, clayey consistency, and running at six

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inches below the surface into a mixture of blue clay and gravel; it was in a very dry state, and had never been previously plowed to a greater depth than five inches. The sole of the plow during the entire trial run in soil which had never before been stirred with the plow. The furrow slice was ten inches by seven inches. The actual draught was 472 pounds; the draught as estimated for each cubic foot turned over, 972 pounds. It worked exceedingly well, pulverizing the ground thoroughly, holds very easily and keeps well in the ground, and has a remarkable power of self-adaptation to the furrow slice.* We ascertained by trial that this plow may be made to do very good work in a furrow eight inches deep and twelve inches wide, or by changing the cutters it will make good flat furrow plowing.

Inasmuch as there was no competition in this class, we should have deemed it our duty to have withheld the gold medal if we had the slightest doubt that it was fully merited, but we have no doubt whatever upon that subject. The material which enters into its composition is of the very best quality, the workmanship is excellent, it is strong and durable, the draught is light, and it has every quality of a good plow in a very eminent degree. We therefore unanimously award a gold medal for this plow in this class. The annexed cut is a very good representation of it. (Fig. 110.)

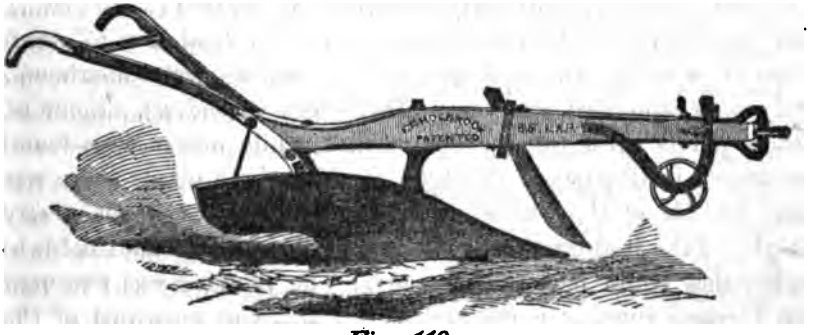

Fig. 110.

CLASS II.—FOR STUBBLE LANDS IN STIFF SOILS.

The entries in this class were:

F. F. Holbrook's No. 66. Weight, 118 pounds. Price, $17. Size of furrow slice, ten inches wide, seven inches deep.

*In view of the extreme tenacity of the ground this shows an exceedingly light draught.

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Collins & Co.'s B 14. Weight, 98 pounds. Price, $25. Size of furrow slice, thirteen inches wide, seven inches deep.

The lot of land on which the trial was had sloped downwards towards the north. It may be described as a stiff clay loam which is underlaid from four to five inches below the surface with a gravelly stratum, consisting of stones varying in size from a hen's egg to a cherry, impacted in a stiff clay. It had never been plowed deeper than five inches. The plows, therefore, had to work in two inches of soil which had never been stirred before. The land had been saturated with water in the early part of the season, and in the latter part it had been baked by the fierce summer sun until it was almost as hard as a brickbat. A luxuriant coat of vegetation had sprung up under these influences, consisting of smart-weed (*Polygonum acre*), mild water pepper (*P. hydropiperoides*), mullein (*Verbascum Thapsus*), Indian tobacco (*Lobelia inflata*); several Asters, chiefly *A corymbosus* and *A cordifolius*, heal-all (*Brunella vulgaris*), red-top (*Agrostis vulgaris*), quack (*Triticum repens*), Fescue grass (*Festuca elatior*), hairy panic grass (*Panicum capillare*)—this was very abundant—scouring rush (*Equisitum arvense*), fox-tail (*Setaria glanca*), three or four species of sedge, thistles (*Cirsium Lanceolatum* and *Carvense*), golden rod (*Solidago Ohioensis?*) yarrow (*Achillea Millefolium*), fled clover (*Trifolium pratense*), white clover (*Trifolium repens*), reabane (*Erigeron Philadelphicum*), daisy fleabane (*Estrigosum*), shepherd's purse (*Capsella Bensa pastoris*), dandelion (*Taraxicum Densleonis*), blue vervein (*Verbena hastata*), water hoarhound (*Lycopus sinuatus*), sunflower (*Helianthus strumosus*). Some of these plants grew together in patches, while others were found scattered in all parts of the lot. Besides these plants there was the stubble of the preceding year, which had been cut pretty high. Take it altogether it was one of the most difficult fields to plow that could be well imagined. The plowing was executed in furrows running north and south; at about one-third of the length of the furrow a line running east and west divided the lands into parts differing essentially in their physical characters. The lower or northern end of the land was more unctuous and adhesive, of a yellow color, and having fewer stones than the upper or southern portion. It appeared to the eye to be more easy to plow than the upper part, but in every furrow the dynamometer showed a greater degree of resistance.

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The annexed Fig., 111, represents Mr. Holbrook's plow No. 66.

The next cuts, Figs. 112 and 113, represent views of the Collinsville plow in competition in this class, and the separate pieces which compose it.

The trials were made on lands one-quarter of an acre in extent. After a very careful examination and comparison, the judges decided upon the several points as follows:

First—Pulverizing power: One-half the judges were of opinion that Holbrook's plow pulverized the soil more effectually than the other. The other half were of opinion that the Collins plow had pulverized the land quite as well as the Holbrook plow. No decision was had upon this point.

Second—Non liability to choke in stubble: The judges were unanimously of opinion that Holbrook's was superior in this respect.

Third—Lightness of draught: The following is the record upon this point:

Holbrook's No. 66.

Width of furrow, 10 *inches*. *Depth of furrow*, 7 *inches*.	READING OF THE DYNAMOMETER.			
	DISTANCE IN YARDS.		HALF POWER IN POUND YARDS.	
	1st furrow.	2d furrow.	1st furrow.	2d furrow.
In hardest soil down hill.....	88	94	16,000	17,600
In hardest soil up hill.....	81	102	14,700	18,300
Iu loosest soil down hill.....	78	78	12,400	11,450
In loosest soil up hill.....	92	70	12,300	9,400

Collins' Plow B 14.

Depth of furrow same as the preceding. *Width of furrow*, 13 *inches*.	READING OF THE DYNAMOMETER.			
	DISTANCE IN YARDS.		HALF POWER IN POUND YARDS.	
	1st furrow.	2d furrow.	1st furrow.	2d furrow.
In hardest soil down hill... ..	109	125	22,400	25,500
In hardest soil up hill.....	119	119	23,000	24,500
In loosest soil down hill.....	44	48	9,100	9,450
In loosest soil up hill.....	53	53	10,300	10,900

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It will be understood that the "hardest soil" of the table is the southern or upper end of the lot, while the "loosest soil" is the northern or lower end of the lot. The "hardest soil" is the gravelly portion, the "loosest soil" is the tenacious portion.

The following table is deduced from the preceding, and shows the average number of pounds required to draw the plow through each yard of the whole furrow:

	HOLBROOK.			COLLINS.		
	FURROW 6 BY 10 INCHES.			FURROW 7 BY 13 INCHES.		
	1st furrow.	2d furrow.	Mean of both.	1st furrow.	2d furrow.	Mean of both.
In hardest soil down hill...	364	375	369	411	409	410
In hardest soil up hill.....	363	359	361	391	412	401
In loosest soil down hill ...	318	294	306	414	394	404
In loosest soil up hill.....	289	269	279	389	411	400
Average of work up and down hill, in hard soil...	363	367	365	401	410	405
Average of work up and down hill, in soft soil....	303	281	292	401	402	401
Average of all the trials....	333	324	328	401	406	403

These numbers are reduced to the power required for each cubic foot of earth by dividing the actual area of a cross section in inches, and multiplying by 144 square inches, which gives the following table:

	HOLBROOK.			COLLINS.		
	1st furrow.	2d furrow.	Mean of both.	1st furrow.	2d furrow	Mean of both.
In hardest soil down hill...	768	770	769	650	646	648
In hardest soil up hill.....	747	738	742	612	652	632
In loosest soil down hill...	654	604	629	655	623	639
In loosest soil up hill.....	550	552	551	615	651	633
Average of work up and down hill, in hard soil...	757	754	755	631	649	640
Average of work up and down hill, in soft soil....	602	578	590	635	637	636
Average of all the trials ...	679	666	672	633	643	638

On comparing these two tables it will be seen that they give different results. The mean average result of all the trials as

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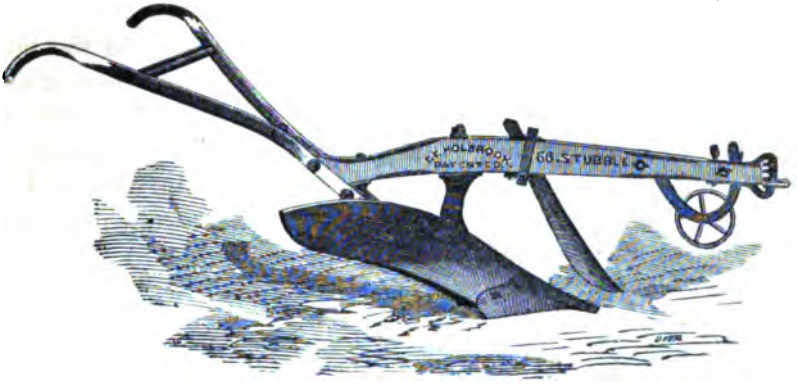
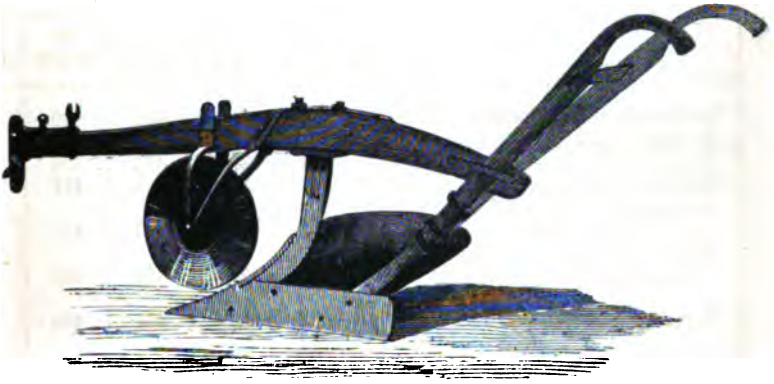


Fig. 111.



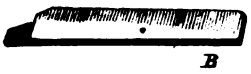


Fig. 112.

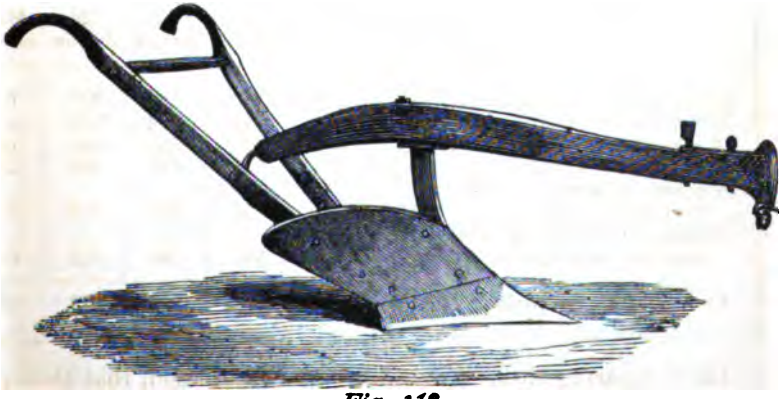


Fig. 113.

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indicated in the first table for Holbrook's plow is 328 pounds. The mean result for Collins' plow is 403 pounds, making a difference of 75 pounds in favor of Holbrook's.

The mean average result according to the second table for Holbrook's plow is 672 pounds, and for Collins' 638 pounds, making a difference of 34 pounds in favor of Collins.

Before the dynamometer was applied it was the opinion of several of the judges who consulted on the subject that as the soil on the lower or southern end of the lot was the most homogeneous that the indications of the dynamometer while passing through it would give the best indications of the relative power consumed by each plow, and it was accordingly resolved to make separate observations upon it.

On comparing the power consumed by each plow while passing through the more homogeneous portion of the furrow it will be seen that the average draught of Holbrook's plow was 590 pounds, while the average draught of Collins' was 636 pounds, showing a difference in favor of Holbrook's of 46 pounds.

SUMMARY.

By the first table Holbrook has the advantage by 75 pounds. By the second table, in "loosest soil," Holbrook excels by 46 pounds. By the second table, the general average, Collins excels by 34 pounds.

The question to be determined is, which of the plows is of the easiest draft?

From the indications of the first table it would seem that the Holbrook plow has the preference, but Collins' plow turned over twenty-one square inches more than Holbrook's and hence appears to do more work with less power. It appears from the experiments of Mr. Morton that only ten per cent of the power required for plowing is expended in turning over the sod, while the remaining ninety per cent is absorbed by friction and by the clearage of the soil. If this statement of Mr. Morton's is correct, then it would be incorrect to assume that the power required is in proportion to the square inches in the furrow slice, and therefore the indications of the second table would not be correct.

A majority of the judges therefore decided that the Holbrook plow had the lightest draught, and they were confirmed in this conclusion by the fact that in the homogeneous soil even by the second table the Holbrook plow was shown to be the lightest.

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Fourth—Ease of holding: Unanimously decided in favor of Holbrook's plow.

Fifth—Durability: Unanimously decided in favor of Collins' plow.

Sixth—Cheapness: Decided in favor of Holbrook.

Seventh—Excellence of mechanical work: Decided to be both equal.

Eighth—Excellence of material: Decided in favor of Collins.

Ninth—Thorough inversion and burial of weeds: Unanimously decided in favor of Collins.

Tenth—Even distribution of wear: No difference of wear.

Eleventh—Regularity or trueness of turning: Decided unanimously in favor of Holbrook's.

The preference was given to Holbrook's plow on the second, third, fourth, sixth and eleventh points, being five points in all. The preference was given to Collins on the fifth, eighth and ninth points, being three points in all, and were decided to be equal on the first, seventh and tenth points, being three points in all.

As the Holbrook has the greatest number of points of excellence, and as it is not objectionable in any point, and as the points in which it excels are the most important ones, the judges agree to award it the gold medal.

CLASS III.

Entries were made in this class by A. L. Brearley & Co., Trenton, N. J., and F. F. Holbrook, Boston.

Holbrook—66, Sod.

No ground, after diligent search, being found in the vicinity of Utica suitable in all respects for a trial of them, the proprietors very politely waived their admitted right to a trial elsewhere, and no trial or award in this class was made.

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CLASS IV.

The State Agricultural Society of New York has long been deeply impressed with the conviction that no one thing was more essential for the enhancement of the profits of agriculture than a deeper and more perfect tillage, and that no one cause was more operative in causing the diminution of several of our most important crops per acre than shallow plowing. In some counties the produce per acre is increasing, in others it is diminishing. In the former the plow runs deeper every year, in the latter it merely skims the surface. In these counties the plow rarely runs deeper than three inches. In some of our best counties the plowing is done as deep as eight or ten inches, but the average depth of plowing over the whole area of the State does not exceed four and a half inches.

It is true that in some sections the surface soil is underlaid by a subsoil which, when first brought to the surface in large quantities, is injurious to vegetation; but there are very few subsoils in the State that are so bad that if plowed in the fall, and one inch of them is brought to the surface where it can be exposed to the ameliorating influence of the atmosphere and the winter frosts they will not perceptibly increase the crop. * If this process is resorted to every other year, almost any soil may be deepened in sixteen years from four inches to twelve inches, thus trebling the range of pasture for the roots of plants, and doubling if not trebling the amount of the crop.

This is not the language of theory, but of sober and often repeated experiments made in every section of the State.

We might write a volume filled with experiments carefully made by weight and measure to illustrate the importance of deep plowing, but we content ourselves with a statement submitted to us by an eminent agriculturalist and statesman whose name would be a sufficient guarantee for its correctness in any part of the United States, which is as follows:

"Some two or three weeks since I visited a farm near here which a young man bought six years ago who used to work for me. When he bought this place it had a barn on it 30 by 40 feet, and it held the entire crop that the farm was capable of producing. He built a barn the first year 100 feet long by 40 feet wide and 20 foot posts, and stabling all below this. This

* Mr Howard dissents from this opinion.

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fall his barns are *nearly full;* ten or twelve tons more of straw or hay would entirely fill them. He has between 800 and 900 bushels of corn, 550 bushels of oats, some rye and buckwheat, potatoes, and 500 bushels of carrots. The farm had been shallow tilled for sixty or seventy years, closely cropped, and the manuring was not liberal. He commenced with some twelve or fifteen acres of sod, plowing it in November *nine inches* deep, manuring it the next spring with twenty-five two-horse loads per acre, and cross plowing it about four inches deep, and planting with corn, &c. The second year the field was stocked to grass with a grain crop, and another field of twelve or fifteen acres of sod taken up and managed like the first. In this way he has gone on from year to year, until now he has plowed all the plowable portion of his farm nine inches deep, which is nearly twice as deep as it had ever before been worked. Next year he commences to go over the same ground again in a similar way, excepting that the plowing will invariably be from two to three inches deeper than before."

Entertaining these views the Society determined to avail itself of this trial in order to turn the attention of the farmers of the State to the importance of deeper plowing than they have been accustomed to, and to furnish them, if possible, with better facilities for accomplishing it than they had hitherto enjoyed.

It therefore offered its highest prize—the large gold medal—for "a plow for stubble land which will cut a furrow twelve inches deep, with three horses, which will raise the lowest soil to the surface of the furrow, and which will not be less than five inches wide."

It knew when it made the offer that a furrow turned so as to lie at an angle of forty-five degrees after reversal must have its depth in the ratio of its breadth as two to three, but it refused to assume any limit to the ingenuity of American engineers and mechanics, and sent out its offer to the world hoping rather than expecting that it would be successfully competed for.

Two plows were entered for this premium, both of them of a very superior character, and both doing the work which was called for.

The trial was in the same field in which Class No. II was tried, and the description of the soil given under that class will answer for this, only as the plowing was so much deeper in Class IV the difficulties arising from the impacted gravel were greatly exag-

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gerated. It may be that worse land to plow can be found, but none of the judges has ever seen worse.

The plow entered by Collins & Co., Hartford, Conn., was a steel plow known as C 3. Weight, 95 pounds. Price, $25.

The plow entered by F. F. Holbrook was a cast iron plow, known as Plow No. 69. Weight, 139 pounds. Price, $24.

This plow is furnished with two mould-boards (as is the case with all Mr. Holbrook's plows), one of which is used for sod, the other for stubble plowing; one of them may be detached and be replaced by the other in a very short time by any plowman.

The judgment on each point was as follows:

First—Pulverizing power: Unanimously decided in favor of Holbrook's.

Second—Non liability to choke in stubble: Unanimously decided in favor of Holbrook's.

Third—Lightness of draught in connection with pulverizing power: The following tables show the results for

Holbrook's No. 69:

Size of furrow turned, 12 inches wide and 12 inches deep.	READING OF THE DYNAMOMETER.			
	DISTANCE IN YARDS.		HALF POWER IN POUND YARDS.	
	1st furrow.	2d furrow.	1st furrow.	2d furrow.
In hardest soil down hill.....	113½	117	33,300	35,700
In hardest soil up hill.....	126	116	41,200	35,400
In easiest soil down hill.....	57½	57	19,800	19,550
In easiest soil up hill.....	47	54	16,700	16,800

Collins & Co.'s C 3.

Size of furrow turned, 12 inches wide and 12 inches deep.	READING OF THE DYNAMOMETER.			
	DISTANCE IN YARDS.		HALF POWER IN POUND YARDS.	
	1st furrow.	2d furrow.	1st furrow.	2d furrow.
In hardest soil down hill.....	70	101½	25,900	31,800
In hardest soil up hill.....	76½	84½	22,000	25,750
In easiest soil down hill.....	85	64½	33,155	28,000
In easiest soil up hill.....	98	88½	27,700	29,150

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The following table is computed from the preceding one, and shows how many pounds were required to draw each plow through each yard in each furrow. For example, if a rope had been attached to the bridle of Collins' plow and passed over a pulley, it would require a weight of 740 pounds, acting by its own gravity, to pull it one yard of the hardest soil down hill in the first furrow, and 617 pounds in the second furrow:

	COLLINS & CO.			HOLBROOK.		
	1st furrow.	2d furrow.	Average.	1st furrow.	2d furrow.	Average.
In hardest soil down hill...	740	617	678	587	610	598
In hardest soil up hill.....	577	609	593	654	610	632
Average.....	658	613	635	620	610	615
In easiest soil down hill....	780	752	766	666	686	676
In easiest soil up hill.....	565	659	612	711	622	666
Average.....	672	705	689	688	654	671
Average of the two soils down hill.....	760	684	722	626	648	637
Average of the two soils up hill.....	671	634	602	682	616	649
Average.....	665	659	662	654	632	643

On examining the tables it will be seen that the average power required to pull the Collins plow in the hardest soil was 20 pounds more than that required to pull the Holbrook plow; in the easiest it required 18 pounds more; the average of all the pulls was 19 pounds more.

This fully establishes the fact that the Holbrook plow has the lightest draught.

N. B.—It will be observed that the above table also represents the power required to turn each cubic foot of earth, because the area of the cross section is just a square foot.

Fourth—Ease of holding: Decided in favor of Holbrook's.

Fifth—Durability: Decided in favor of Collins'.

Sixth—Cheapness: Decided in favor of Holbrook's.

Seventh—Excellence of mechanical work: Adjudged equal.

Eighth—Excellence of material: Decided in favor of Collins'.

Ninth—Thorough inversion and burial of weeds: Decided in favor of Holbrook's.

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Tenth—Even distribution of wear: The difference in this respect was very slight, but while every part of Holbrook's mould-board was evenly polished, there were a few points in Collins' which had evidently less rubbed. Slight as the difference was, there was a difference, and we were therefore compelled to decide this point in Holbrook's favor.

Eleventh—Regularity or trueness of turning: Decided in favor of Holbrook's.

SUMMARY.

The first, second, third, fourth, sixth, ninth, tenth and eleventh points, eight points in all, were decided in favor of Holbrook's plow. The fifth and eighth points were decided in favor of Collins' plow, and they were adjudged to be equal on the seventh.

The judges therefore decided that Holbrook's plow was the best one, and as it fully met the requisitions of the Society, they adjudged to it the LARGE GOLD MEDAL.

The annexed cut, Fig. 114, gives a tolerably clear idea of the appearance of Holbrook's prize plow No. 69.

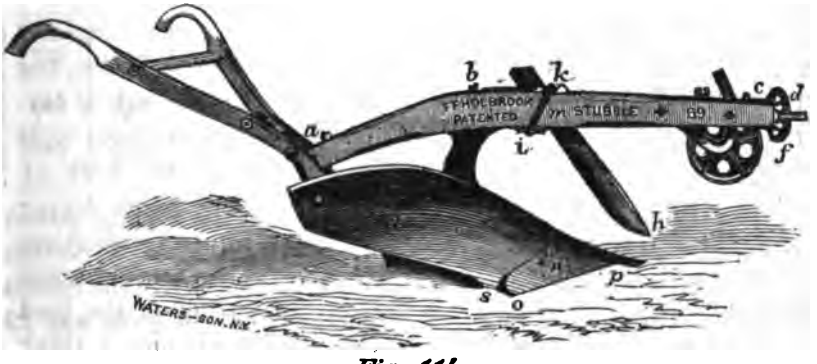

Fig. 114.

It will be observed that it enters the ground with a very low inclined plane, rises by an easy curve which elevates the slice into the air, and then by a succession of sharp twists in different directions it cracks the slice, and if it is in a tolerably dry condition reduces it to powder.

The Society called for a plow "which will raise the lowest soil to the surface of the furrow." This was done by this plow at Utica to the very letter of the requirement, but as we desire that the public may exactly understand the whole case, we must state that owing to the extreme dryness of the soil and its minute pulverization, the lowest soil, after being lifted to the top of the

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furrow, fell back again into the furrow channel to some extent. We did not consider this an objection, as it promotes that mixing of the soil which we have shown to produce such good effects; but it is proper to add that we saw this plow work subsequently in the soil of the Connecticut valley, where there was more moisture in the soil, and there, none of the soil fell back into the furrow channel, but the furrow, twelve inches deep, was turned over as handsomely as could be desired and remained just as it was first laid

The adhesive character of the soil in this valley enabled us to study the action of the twist of the plow to great advantage. We could see the horizontal laminations and the vertical and transverse cracks just as they were produced by the various curved lines on the surface of the mould-board, opening the whole interior of the furrow slice to the air.

We are aware that we shall shock the prejudices of all farmers by the assertion, but we cannot refrain from expressing our deliberate conviction that this plow put the land at Utica in a better condition for a crop than it could possibly have been put by the spade. We have seen very active laborers who have spaded sixteen square rods of earth a day to a depth of seven inches, but the *average* day's work does not exceed ten square rods a day. One man and three horses will plow two hundred and forty rods a day; or, in other words, three horses will do the work of twenty-three men, and in addition will stir it five inches deeper and leave it in a mellower condition. There can be no question, therefore, of the great value of this plow. Its performances astonished every one who saw it operate. A portion of the land plowed was the site of an ancient brick yard, containing a thick stratum of angular fragments of burned brick tightly imbedded in an indurated bed of blue clay, yet the plow passed through it without stopping, and completely pulverized every part of its immense furrow slice of twelve inches square. In two or three instances the plow was arrested suddenly by large boulders deeply impacted in the soil, but no part gave way in the least, even when subjected to this sudden strain. This, in our opinion, is a conclusive test of the great strength of this plow, and of the judicious distribution of the material which enters into its composition to resist the strains and shocks which it has to encounter.

After a most careful and thorough examination of all the separate parts of this plow, considered individually and in combina

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tion, having applied all the tests known to us, and having seen it work in a variety of soils, and under very diversified circumstances, we are compelled to record our deliberate opinion that this plow is one of the most valuable contributions that the mechanic arts have ever made to agriculture, and that its wide diffusion through the State of New York will add immensely to the profits of agriculture by greatly increasing the fertility of land at a very small cost.

We subjoin a full and minute description of the plow and its constituent parts.

DESCRIPTION OF F. F. HOLBROOK'S PLOW NO. 69—CLASS IV, ENTRY NO. 19.

There is a point in every mould-board which coincides with the edge of the slice at the instant that it assumes the perpendicular position, and which is vertically above the sole of the plow, the exact breadth of the furrow. This is called the *zero point*, and a vertical line drawn through it and produced to the sole is the *zero line*. In measuring this and all other plows described in this report, we have dropped a plumb line to the plane of the sole and measured in a straight line backward and forward to the point from the zero line thus ascertained.

	Inches.
From the zero point to the tip of the handle	41¼
From the zero point to the second cross-brace	27¼
From the zero point to the first cross-brace	16¼
From the zero point to top of flanch where the handles are secured	11½
From the zero point to bottom of handles	7
From the zero point to rear edge of mould-board	3¼

All the above measurements are rear; the rest are in front of the zero point.

	Inches.
From the zero point to heel of land side	1
From the zero point to centre of standard	13¼
From the zero point to rear end of sole of share	15
From the zero point to front of standard	16¼
From the zero point to rear edge of coulter at top of beam	22¼
From the zero point to angle of feather	21
From the zero point to front edge of coulter at top of beam	25¼
From the zero point to fore end of feather	31½
From the zero point to point of share	33¼
From the zero point to point of coulter	35
From the zero point to centre of wheel	43½
From the zero point to fore end of beam	51¼
From the zero point to centre of holes in bridle	52½

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The whole length of the implement, from the tip of the handle to the bridle, is therefore 6 feet 7¼ inches. The whole length on the land side is 2 feet 8¼ inches, and from the point to the rear edge of the mould-board is 3 feet ½ inch.

Vertical Measurements.

	Inches.
From the tip of the handles to base line	34½
From the highest point of the handles to base line	38
From the second cross-brace to base line	31½
From the first cross-brace to base line	22
From the highest point of the handle flanges to base line	19½
From the upper and rear end of beam to base line	17
From the upper edge of beam, where the standard passes, to base line	22½
From the upper edge of beam, in front of coulter, to base line	22
From the upper edge of beam, extreme front, to base line	20
From the centre of lower hole in bridle to base line	16½
From the centre of upper hole to base line	22

The Handles

Are made of oak wood. The left one lies 6¾ inches to the left of the plane of the land side. The right handle is 30 inches from the tip of the left one. The distance (measured on the inside) between the handles at first cross-brace is 2¾ inches; at the second cross-brace, 17 inches. Width between them where they enter the flanges, 1⅛ inches. From the lower end of the handles to the top of the flange, 9¾ inches; to first cross-brace, 16 inches; to second cross-brace, 31 inches. The three last measurements are made upward in the line of the slope of the handles. They are 2½ inches wide and 1½ inches thick. The first cross-brace is made of iron, cast hollow in the middle, and with flanges at either end bevelled to suit the spread of the handles; a bolt rod runs through it, headed on the right side and secured by a nut on the outside of the left one. The second brace is made of wood, shouldered, with the ends projecting through holes in the handles made to receive them, an iron bolt passing through half an inch above them, headed on the left and nutted on the outside of the right one brings their upper part firmly together and prevents their outward flexure as the wooden one prevents their inner flexure. The rear standard, Fig. 115, B, rises upward and backward, having on its upper extremity flanges, *c d*, three-quarters of an inch deep on both sides and on the front and rear faces which receive the lower ends of the handles, and which are bolted through it.

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Beam.

A step, Fig. 115, *b*, projects 1¾ inches forward from the front edge of the rear standard; a nipple, *e*, also projects forward a little above the step which enters the rear end of the beam, and resists its lateral movement. The beam rests upon the step, and is secured by a bolt running diagonally through it and through the rear standard, which is headed on the beam and nutted on the standard. Its size, Fig. 114, *a*, at this point is 3 inches vertically and 2¼ inches horizontally. At the point, Fig. 114, *b*, where the standard bolt passes through it, it is vertically 4½ inches and horizontally 2¾ inches. At the extreme front, *c*, its cross section is 2½ inches square. Its whole length, from front to rear, measured along the line of its upper curves, is 5 feet ½ inch. Measured along a straight line, from heel to point, it is 4 feet 11 inches. Its upper surface rises from the heel, curving upward and forward to the centre of the front standard; from thence it descends in a slight curve to its front extremity. The following measurements, vertically from the base line to the top of the beam, will more clearly show the character of the curves:

From the top of the heel of the beam, *a*, where it joins the rear standard, 16¾ inches; one foot in advance of this point it is 21¼ inches; at three feet it is 22½ inches; at four feet it is 20⅜ inches; at the fore end it is 19¾ inches.

The vertical measurements from the same points on the base line to the *under* side of the beam are: At the heel, 15 inches; one foot in advance, 17½ inches; at two feet, 17⅝ inches; at three feet it is 17¾ inches; at four feet it is 17½ inches; at its front it is 17⅜ inches. The material is of white oak, and its line of direction is parallel with the plane of the land side. The land side face of the beam at the heel is 1⅛ inches within the land side plane, and at the front it is 1⅜ inches within it. The attachments to the beam are, first, the bridle; second, the wheel; third, the coulter; fourth, the skim-plow.

The Bridle,

Fig. 114, *d*, consists of a semi-circular iron arc three-fourths of an inch in front of the fore end of the beam, pierced with seven holes which pass horizontally through it, the upper one being six inches above the lower one. A strap extends backward from the upper and lower part of the arc 8½ inches in length, embracing the upper and lower faces of the beam, which are pierced with

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three holes respectively 3½, 4½ and 8 inches behind the arc. A bolt passes through the rearmost holes, on which the bridle rotates as a centre horizontally. A bolt passes through either the 3½ or 4½ inch holes, which secures the bridle in the line of the beam, or it may be thrust through holes drilled in the beam, one inch to the right or left of the central holes, which causes the plow to take more or less land. An extent of lateral motion, amounting to 3½ inches, is secured by this arrangement, while the tendency earthward is regulated by the vertical holes in the bridle.

The Wheel,

Fig. 114, *f*, is made of cast iron, 10¼ inches in diameter and 1½ inches wide. The land side face is a flat plate, perforated by five holes, each 3 inches in diameter, and having lateral ribs on each side between the holes. Its centre, when running at a depth of 8 inches, is 9 inches behind the fore end of the beam. It is hung on a U shaped attachment, *a c b*, Fig. 84, having its right limb at its upper extremity sharply curved and prolonged to the right. Eighteen inches behind the fore end of the beam a bolt passes horizontally through the right extremity of the limb and through the beam of the plow, on which it rotates vertically. The axle of the wheel projects towards the left from the lowest portion of the curve. A cast iron button, having a pin on its rear extremity which projects towards the right and enters the beam about half an inch, is its centre of rotation. It has a shoulder cut at its fore end, through which the left limb slides upward and downward. A bolt passes through the middle of the button and through the beam, having a thumb screw on the right side of the beam, by which the left limb of the wheel attachment is securely clamped at any point through a vertical range of ten inches.

The Coulter,

Fig. 114, *h*, is 2 feet 2½ inches long; cutting edge, 10½ inches; it is 3 inches wide and ½ inch thick, and has a curved taper from the back to the point. The angle which its cutting edge forms with the base line is 64 degrees. Its point stands 4 inches above the sole and ¼ of an inch inward from the plane of the land side, in which respect it varies very materially from most plows. It is set against the land side of the beam, to which it is secured by a clamp formed on three sides by a ⅝-inch round iron rod, having screws cut on the ends which project beyond the right face of the beam. Cast iron plates, *k* and *i*, furnished with three semi-cylin-

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drical and horizontal depressions, are placed one above the beam in front of the coulter, and the other below the beam and behind the coulter. On these the rods rest, fitting into the semi-cylindrical depressions. When the cutting angle is as above described, the rods are placed in the middle depression in each plate. If it is desired to vary the angle, so as to make it greater of less, the rods are shifted into corresponding depressions. An iron strap, *m*, perforated with holes at each end, passes over the projecting ends of these cross-rods, and is screwed tightly against the beam by nuts, which keeps the coulter firmly in the angle in which it has been set. The coulter is kneed inward to the furrow side so as to bring its land-side face nearly into the plane of the land side.

The reader will observe, on examining the figure of this plow, which we have given above, or, still better, the plow itself in our museum, that the line of the shin or breast varies considerably from any others. Instead of being curved, it is nearly in a straight line; it is a long taper wedge which insinuates itself into the ground very easily; and then, when the slice is once raised into the air, there is a sharp and sudden twist of the wing of the mould-board which breaks it in pieces and completes the pulverization. As an illustration of the lifting power of the plow, we may mention that we repeatedly found, on measurement, that the upper edge of the slice, when it was at the extreme point of the wing of the mould-board, was 28 inches above the bottom of the furrow. It may be further observed that this plow, like all those exhibited by Mr. Holbrook, are susceptible of four changes: first, they may be used as sod plows; second, by a change of mould-board, it may be converted into a stubble plow; third, by the addition of a skim plow on the front of the beam, it may be changed to a sod and subsoil plow; fourth, by a change in the position of the coulter, it may be made to turn a lap furrow or a flat furrow.

The Skim Plow

Is attached to the land side of the beam by two bolts passing through the standard and fastened by nuts on the mould-board side.

The Land Side, Mould-Board and Standard

Are all cast in one piece, and are braced by a rod running from the rear of the mould-board to the land side cast in the same piece with them. The lower end of the mould-board has a

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shoulder into which the share is fitted and secured by one bolt. The standard, Fig. 116, H, is 10 inches high and 6 inches wide, and, including the flange, which runs around the top and both sides, is 1 inch thick. It has an oblong opening, c, of 7 inches by $2\frac{1}{2}$, the sides of which are also ribbed. There are five holes on each side of this opening which permit a vertical range of six inches to the sole of the share. The land side is a continuation of the standard, and the breast is a continuation of its curve. The length of the sole of the land side is $6\frac{5}{8}$ inches. The curve of the mould-board differs from that of the plow. The first line, coinciding with a straight edge, runs from the point of junction between the share and land side at the breast back to a point on the lower edge of the mould-board, $2\frac{3}{16}$ inches above the plane of the sole, which makes an angle with that plane of 6° 11′. The upper line runs from a point on the upper edge of the mould-board, $7\frac{1}{4}$ inches above the sole, to a point in the rear edge, $8\frac{1}{8}$ inches above it, and makes an angle with it of 4° 34′; the intermediate lines vary in proportion. The vertical lines, in which a straight edge coincides with the surface, vary more in their angles with the first horizontal line than the lower share. Near the standard this angle is 71°; the next towards the rear makes an angle of 83°; the next, 85°; the next, 87°; the next, 94°; the next, 97°, and the one nearest to the rear edge is 113°.

Share.

Length of the land side of the share, $4\frac{3}{4}$ inches; length of the point, $1\frac{1}{2}$ inches; length of the feather, 9 inches; distance of angle of feather from bottom of the mould-board, $2\frac{1}{4}$ inches. The coulter is cast in the same piece with the share; it rises at an angle of 43°, and is concave on its edge. The point is $1\frac{1}{4}$ inches broad. The sole of the share and of the land side both slope upward. A straight edge laid from the heel to the point forms the base of a triangle whose apex is at the junction of the share and land side, and whose height is $\frac{1}{2}$ inch. The face of the land side slopes towards the furrow side; at 4 inches above the base line it is $\frac{1}{8}$ inch inward. The top of the coulter is $\frac{1}{4}$ of an inch inward from the land side plane. The breadth from the angle of the feather to the land side is $7\frac{3}{4}$ inches.

We now come to the plow proper, or to those parts which are directly concerned in turning over the furrow. These are the share, the land side and the mould-board, with their attachments.

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The Share,

Fig. 114, *n* (outside), Fig. 116, *g*, (inside view), is made of cast iron, and forms part of the land side and part of the mould-board side of the plow. Its length on the land side is 9 inches; length of point, 2 inches; length of share on the mould-board side, Fig. 116, *a b*, measured from the point, over the feather, to its intersection with the mould-board, 16½ inches; width from land side to the angle of the feather, Fig. 114, *o*, 10⅛ inches; length of feather, Fig. 114, *o p*, Fig. 116, *c d*, 13½ inches (measured on the sole); width of point, Fig. 116, *a a'*, 1¼ inches. The feather extends 2 inches beyond the edge of the mould-board to the right, and is bolted to it by two bolts, Fig. 116, *e f*, secured by nuts. At the line where the mould-board meets the share at the breast its vertical height above the base line is 3⅞ inches. At the point where the upper surface of the mould-board meets the share the height is 2 inches. Distance from the angle of the feather to the lower edge of the mould-board is 3¼ inches. The land-side of the share begins to depart from the plane of the land side towards the left from the point of its junction with it at its fore end, at the point it stands ¼ of an inch more to the left than the plane of the land side. The land side face of the share slopes vertically inward towards the furrow side, in conformity with the slope of the land side.

The Land Side.

The sole of the land side, *c*, Fig. 115, is cast in a separate piece, 1 inch deep and 2 inches wide at the rear end, and $\frac{5}{16}$ of an inch deep and ¾ of an inch wide at the front end. It receives the lower edge of the land side plate on its upper surface. On the furrow side it has two semi-circular steps of 1½ inch radius, *e* and *f*, one being 6 inches and the other 21 inches in the rear of its fore end, through which it is bolted to the land side plate. Through these the sole is bolted to the land side plate, the heads being on the outside and the nuts on the inside. The holes in the plate are countersunk to receive the heads of the bolts, so that they lie in its plane. The sole extends ½ an inch to the left of the plane on the land side, at the rear end, running out to nothing on the front end, where it joins the share. A straight edge, extending from the heel of the land side to the point of the share, will form the base of a triangle whose apex is at the point of junction of the land side and the share, and whose altitude will be ¼ of an inch. If the sole of the land side is produced to the point, the end of the

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line will be $\frac{3}{8}$ of an inch above it; or it may be otherwise stated, that the sole of the land slopes upward and forward, and the sole of the share slopes upward and backward to the point of their junction. The object of giving it this concavity is to diminish friction and to give dip or earthward tendency at all times, together with steadiness of motion. The land side is inclined vertically inward, so that at 12 inches above the sole it inclines $1\frac{1}{2}$ inches from the perpendicular. The front standard, A, is cast in the same piece with the land-side plate; its front face forms a continuous curve with the breast, its radius growing smaller as it rises, until at length the line of the curve moves forward. It is flat on the land side and convex on the furrow side. It is cast hollow, which permits a bolt to pass vertically through it, its head being on the under side and a nut which screws on the upper surface of the beam. It is 3 inches wide and $1\frac{1}{2}$ inches thick. Its upper termination is in a plate, *a*, 6 inches long and nearly as broad as the beam which rests upon it. The rear standard is cast in the same piece with the land side plate, and is provided with flanges at its upper end, which receives the lower ends of the handles, as described above.

We give the anneked cut (Fig. 115) of the front and rear standard, A and B; *a* and *b* are the flanges upon which the beam rests; *c* and *d* the flanges which support the handles. D, the

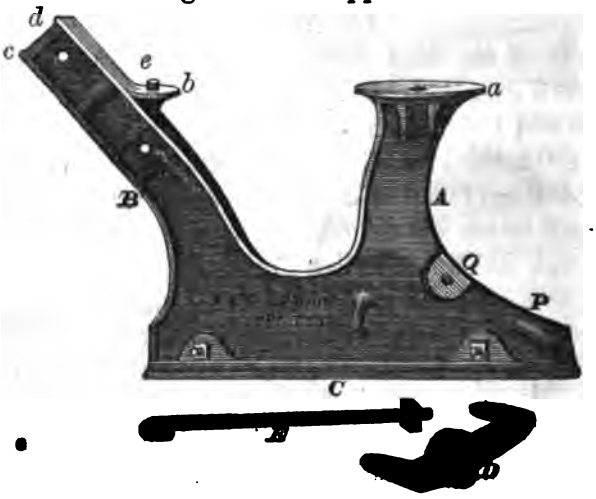

Fig. 115.

dog-brace. One of the teeth enters the staple seen on the inside of the land side; the other enters into a corresponding staple, s (Fig. 116), in the mould-board. The hook on the left end of the

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dog-rod catches into a staple, *k* (Fig. 116), on the mould-board; the screw end passes through the hole seen in D, and is secured by the nut. By this arrangement the land side and mould-board are held firmly together as one piece.

The Breast.

A straight line drawn from the point of the share to its junction with the standard measures $22\frac{3}{4}$ inches. The ordinates to the breast curve, measured along this line, are, at 4 inches from the standard, $\frac{1}{2}$ of an inch; at 8 inches, $\frac{13}{16}$ of an inch; at 12 inches, $\frac{13}{16}$ of an inch; at 16 inches, $\frac{10}{16}$ of an inch; at 20 inches, $\frac{5}{16}$ of an inch.

The Mould-Board,

Fig. 114, *r*, Fig. 116, *g*, rises regularly from the base line and forms a continuous curve with the upper surface of the share; but a vertical flange, *s*, descends from its front lower edge to the sole. The rear edge of this flange is $19\frac{1}{2}$ inches behind the point

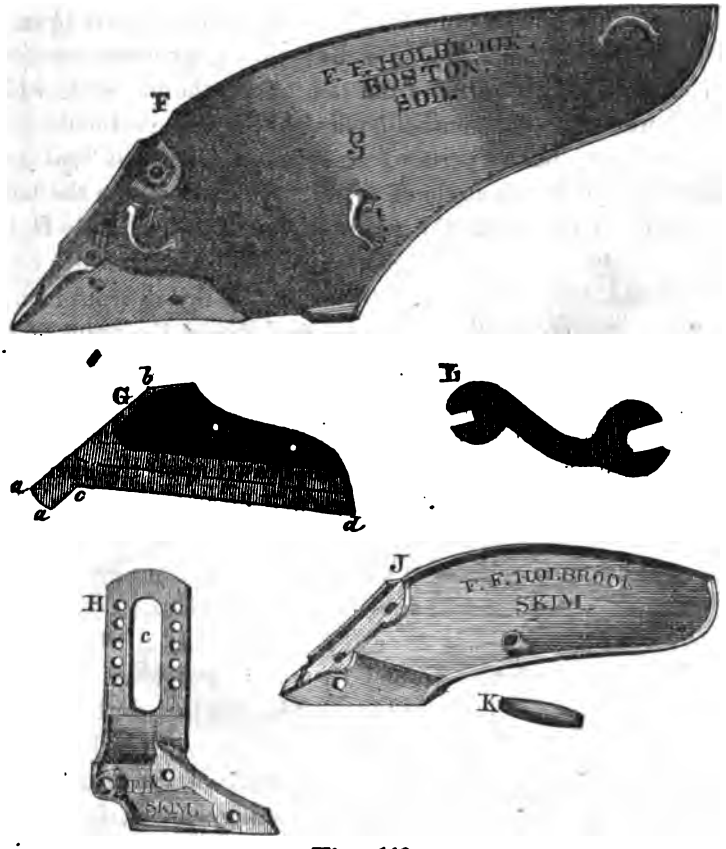

Fig. 116.

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of the share, measured on the base line. The dog-brace D, and dog-rod E, Fig. 115, take the place of the thimble-brace formerly used. The dog D being more convenient, is preferred. A $\frac{5}{8}$ wrought iron brace extends from the top of the rear standard diagonally across to the rear of the mould-board. It is 15 inches long, and hooks at both ends into staples which are cast on these plates, and which, on the mould-board, is $4\frac{1}{4}$ inches below its upper edge, and 5 inches in front of its rear edge. A series of straight lines, which coincide at all points with a straight-edge running from the front to the back part of the mould-board. The first of these extends from the land side of the point of the share to a point in the lower edge of the mould-board, which is $2\frac{3}{8}$ inches vertically distant from the plane of the sole, and 18 inches distant from the point forms an angle with the plane of the sole of 5° 02′. Another of those lines, drawn from the point where the land side joins the mould-board on the breast, to a point in the lower edge of the mould-board $7\frac{1}{8}$ inches vertically distant from the base line, forms an angle of 4° 08′. Another of these lines runs from the top of the breast to a point in the lower edge of the mould-board $11\frac{5}{8}$ inches vertically above the base line. The uppermost coinciding line at the top of the mould-board forms an angle of 3° 20′. It will be seen that these lines form angles with the plane of the sole gradually though not absolutely regularly diminishing as they rise vertically on the mould-board. Another set of lines may be drawn from front to rear forming angles with the first named line at the point of 62°, and at the rear of the mould-board of 85°, the intermediate lines forming angles gradually increasing from front to rear, but, as in the case of the other set of lines, the rate of increment is not entirely regular. If these lines are drawn upon the surface of the mould-board their intersections will form trapezoids; if the diagonals are drawn on any of these it will be found that a straight-edge applied to one of them will show a concave surface, while at the cross diagonal it will show a convex surface.

The mould-board closes over the land side at the breast by a lip; it also has a flange around its upper and lower edge one-half an inch broad. The mould-board is attached to the standard by means of the pin seen in Fig. 115, and marked P, which enters a thimble cast at the lower end of the inside of the mould-board, *h*, Fig. 116; it also rests on the projecting ear, O, Fig. 115, to which it is fastened by a bolt and nut. By this simple arrange-

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ment the mould-board can be readily changed from a sod to a stubble plow, and *vice versa*. The dog, D, hooks into *g*, Fig. 115, and into *i*, Fig. 116. The rod, E, hooks into *k*, and the nutted end passes through the hole in the middle of the dog, which braces all parts firmly together.

While we have been compelled by the results of the trial to give a very decided preference to the Holbrook plow, we intend to bestow a strong commendation upon its competitor, which is in all respects a very excellent plow, though not as well adapted to deep plowing as Holbrook's. The material of which it is made is the hardest and least frangible steel that ever came under our notice. This was very strikingly exemplified, when a stone two feet long, eighteen inches wide and three inches thick was caught between the revolving cutter and the breast of the plow and torn out from ten inches beneath the surface of the ground. The cutter was pressed by this operation fully three inches to the right of its natural plane, but when released it sprang back to it again without injury to it or to any part of the plow.

We know nothing of the process by which these desirable properties are imparted to the steel, but we can fully testify to the excellence of the article. It pulverizes the ground remarkably well for a concave plow, and buries the weeds and stubble tolerably well. In our opinion it would be better if it were longer and less abrupt; and we think the breadth from the land side to the angle of the feather on the share is too great, as it does not leave a hinge sufficiently wide for the furrow slice to turn in. We give the following full description of it:

TURF AND STUBBLE PLOW C No. 3. COLLINS & CO., HARTFORD. F. F. SMITH, PATENT. CLASS IV, ENTRY No. 13.

This plow is of cast steel, with the exception of the standard, which is of wrought iron, and the bolts and brace rods, which are also of wrought iron, and the bridle, which is of cast iron; the beams, handles and one cross-brace are of wood.

General Dimensions.

	Inches.
From zero to rear end of mould-board	4½
From zero to heel of land side	5
From zero to first cross-brace	5
From zero to second cross-brace	10½
From zero to extreme tip of left handle	33
From zero to rear edge of standard	8½
From zero to rear corner of feather	12

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	Inches.
From zero to junction of land side with share	17
From zero to point of share	28
From zero to extreme front of beam	52
From zero to front hole in the bridle	53¼

These points are all referred to the base line by a plumb line, and then measured horizontally backward and forward from the zero line. This line is found on the mould-board at the point where the furrow slice touches it when it is set perpendicularly on its edge, or by finding the point where a line at right angles from the land side as long as the breadth of the furrow slice touches the mould-board, and also above the sole as much as the furrow is broad.

It will be seen from the above that the extreme length of this plow is 7 feet 2¼ inches from the tip of the handles to the front of the bridle. And the whole length from the heel of the land side to the point is 2 feet 9 inches. The tip of the left handle lies 3¾ inches to the left of the plane of the land side.

Vertical Measurements.

	Inches.
From base line to the tip of the handle	33
From base line to the highest point of the handle	35¼
From base line to third cross-brace between handles	28¾
From base line to second cross-brace between handles	18½
From base line to first cross-brace between handles	11½
From base line to top of beam at rear edge of standard	23¾
From base line to top of beam at front end	18¾
From base line to upper hole of bridle	20¼
From base line to lower hole of bridle	14¼

Handles.

An iron strap, one-half an inch thick and 2¼ inches wide, is bolted to the inner face of the land side, 8 inches in advance of the heel and 3¼ inches above the sole. It rises upward and backward, making an angle of 48° with the base-line, and is continued 15 inches above the bolt. It is twisted or kneed inward so as to make its outer or left plane coincide with the inner or right hand face of the left handle, which is bolted to it and is in contact with it for 6½ inches. This handle passes upward through a mortise in the beam, and after ascending 6 inches above begins to deflect towards the left from the plane in which it previously stood. It is two inches broad (*i. e.* on its sides) and 1½ inches thick (*i. e.* on its front and rear edges). Below the beam its form is semi-cylindrical, and the bolts which hold it in contact with the

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iron strap are headed with a clip which embraces their whole circumference and correspond with them in form. Above the beam the sides are trimmed off on the edges so as to give them a well marked convexity.

The right handle is bolted by two bolts, 6 inches apart, to the mould-board. A half inch wrought iron brace rod, 15 inches above the bolt, which fastens the iron strap to the land side, passes between the handles, and is 7¼ inches long. Another iron brace rod, curved upward in the middle and having a screw cut upon both ends, passes through the beam and both handles; each end is secured by two nuts, one on the outside, the other inside, thus resisting both outward and inward pressure. It is 10¾ inches in length, and is 11 inches above the first one measured on the left handle, and 14 inches measured on the left one. A third brace rod of wood, 15 inches above the last one, as measured on the left handle, and 17½ inches on the right handle, is 18 inches long, measured as the others have been on the inside of the handles. One inch above this is a quarter-inch iron rod, which passes through both handles, and is secured by a nut on the left one. The distance between the tips of the handles is 28 inches, and as we have before stated, the tip of the left handle lies 3¾ inches to the left of the plane of the land side, the tip of the right handle must lie 24¼ inches to the right of that plane. Both handles are made from wood.

Beam.

The beam is made of oak wood. Measured along the top, in conformity with the curves, it is 5 feet 7½ inches long. Measured in a straight line, it is 5 feet 6 inches long.

The following measurements, made vertically from the base line to the top of the beam at the points indicated, will give a tolerably distinct idea of its curves:

	Inches.
From base line to extreme rear end of the beam	18
From base line to the point where the front edge of the left handle passes through the beam	4¼
In advance of the preceding measurement	19⅝
From base line at 1 foot in advance of first measurement	21⅝
From base line at 2 feet in advance of first measurement, which corresponds with the rear edge of the standard	23½
From base line at 3 feet in advance of first measurement	22¼
From base line at 4 feet in advance of first measurement	20⅝
From base line at 5 feet in advance of first measurement	18½
From base line at the extreme front of the beam	18¼

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Similar measurements to the under side of the beam:

	Inches.
At the heel	16¼
At 4½ inches in advance	17¼
At 1 foot in advance	18½
At 2 feet in advance	19⅝
At 3 feet in advance	18½
At 4 feet in advance	17¼
At 5 feet in advance	16¼
At front end of beam	16¼

The beam projects 2 inches behind the left handle of the plow. At the hinder end it is 3 inches deep and 2⅝ inches wide. At the standard it is 4½ inches deep and 2¾ inches wide. At the front it is 3 inches deep by 2½ inches wide.

The Land Side

Is made by a single plate of cast steel, 21 inches long, and 5 inches deep, and three-eighths of an inch thick, bevelled off at its upper front edge to meet the breast curve of the share and mould-board. At its rear end a wear iron projects three-fourths of an inch laterally towards the land, which extends 8¼ inches forwards and then runs out, the land side and share being thenceforward in one plane. The wear iron also extends 2 inches diagonally upward, and is then lost in the plane of the land side. At its junction with the share the plate is thickened on the inside, and a gain is cut on the end outside face, which extends 2 inches over the interior face of the share at the point they are bolted together.

From a point 11 inches in front of the heel and 3 inches above the sole, a wrought iron brace, seven-eighths of an inch wide and three-eighths of an inch thick, crosses over to the mould-board. It is bolted to both through flanges which turn downward at angles corresponding with each plate. The land side is exactly perpendicular to the plane of the sole for six inches vertically.

Share.

A straight edge laid from the heel of the land side to the point of the share forms the base of a triangle, the apex of which is at the point of junction between the land side plate and the share, its altitude being one-half an inch. A straight edge laid upon the sole of the land side and produced is a qurter of an inch vertically above the point. The point is exactly in the plane of the land side and not set towards the left as is usually the case. It is also in a straight line with the sole of the share. The angle

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of the feather is 12 inches, measured at right angles with the exterior face of the land side. There is no marked line of separation between the point and the rest of the share; its breadth is one-half an inch. The edge of the feather from the point to the angle is regularly concave on the sole. The length of the chord connecting the point with the angle is 19¾ inches, and the longest ordinate to the curve is three-fourths of an inch. The distance of the angle from the bottom of the mould-board is 5⅛ inches; it is brought to a cutting edge along the sole for its entire length, and does not vary anywhere from the plane of the sole. The vertical height of the breast at the junction of the share and land side is 4 inches, and at the standard 10 inches. The length of the share on the land side is 10¾ inches. The upper edge of the share coincides with the lower edge of the mould-beard in a straight line. An iron plate three inches wide is applied along the line of junction on the inner face and unites the two by means of two bolts passing through the plate and the upper edge of the land side, and two through the lower edge of the mould board.

The Standard

Is of wrought iron, 2¾ inches wide and three-quarters of an inch thick; it is straight until it reaches the breast of the plow; it then curves forward to correspond with it. It twists inward when it meets the land side and has a gain cut in the lower end to receive the land side plate which is bolted to it; it terminates above in a plate six inches long and three inches wide, having transverse slots cut at each end, through which bolts pass upward through the beam secured by nuts upon its upper surface. By this arrangement the angle made by the beam and the plane of the land side may be varied at pleasure. The land side is perpendicular to the sole for six inches; from thence upward the standard inclines to the furrow side; at 12 inches above the sole it deflects three-fourths of an inch. A line drawn from the point to the top of the breast where it meets the standard is 19½ inches, and the longest ordinate to the curve of the breast is 1¾ inches.

The Mould-Board

Is of cast steel, which is three-eighths of an inch thick. It has straight transverse lines, but its vertical lines are concave. We

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did not perceive that the twist conformed to any mathematical principle, but it worked very well in practice.

CLASS V—SOD AND SUBSOIL PLOWS.

The only entry in this class was by F. F. Holbrook, of Boston, and consisted of the plow used in Class IV, with a skim plow attached to the beam in front, as seen in Fig. 117. Entry No. 20. Weight, 150 lbs. Price, $27.

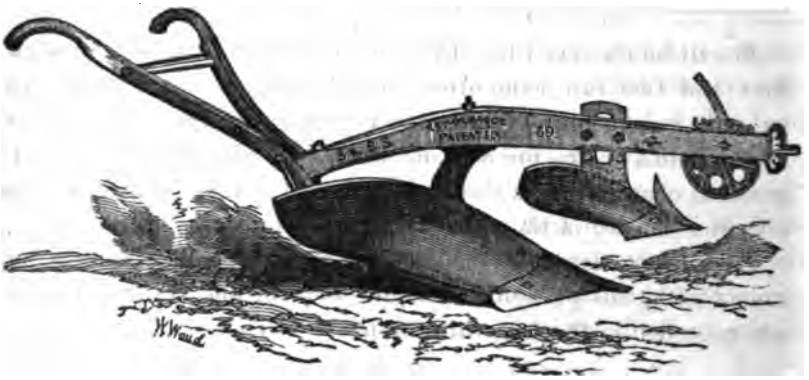

Fig. 117.

A full description of the stubble plow will be found in Class IV. The sod and subsoil plow is No. 69, with a stubble mould-board and the skim plow attached. It works from 8 to 14 inches deep, by 10 to 14 inches wide, according to the wishes of the plowman.

In our trials at Utica, on ground as adverse to its good performance as could well be imagined, it worked 11 inches deep and 11 inches wide for the first two furrows, and 11 inches deep and 12 inches wide for the second two furrows.

The following table shows the force which was consumed:

FURROWS.	Distance in yards.	Half power in pound yards.
First	153	45,000
Second	151	43,500
Third	153	57,500
Fourth	152½	55,600

The annexed table gives actual draught reduced from the above table, the draught per cubic foot, and the averages.

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SIZE OF FURROW.		DRAUGHT.		AVERAGES.	
Width in inches.	Depth in inches.	Actual.	Per cubic foot of earth.	Actual.	Per cubic foot.
11	11	588	700	582	693
11	11	576	686		
12	11	752	820	741	807
12	11	730	795		

It will be observed that the average difference between the two first and two last, amounting to 159 pounds, is altogether too great to be accounted for by the very slight increase of one inch in the width of the furrow, and was obviously due to the heterogeneous character of the soil, which varied very greatly in tenacity and density in the space of a few feet.

In order to determine this matter more fully, we made experiments with this plough at various depths, the results of which are recorded in the following tables:

Holbrook's Sod and Subsoil.

Width of furrow, 12 *inches.*	Depth in inches.	Distance in yards.	Half power in pound yards.
First furrow	8½	154	50,800
Second furrow	10½	146	55,000
Third furrow	12½	149	59,700

In the following table these numbers are reduced to actual draft and draft per cubic foot in pound yards:

DEPTH OF FURROW	Actual draught.	Draught per cubic foot.
8½ inches	660	931
10½ inches	753	861
12½ inches	801	785

This shows the heterogeneous character of the soil in a very striking manner. In the first experiment 121 square inches of furrow slice were turned over, with a force of 582 yard pounds; in the second experiment 660 yard pounds were required to turn over a furrow slice of 102 square inches.

In the first experiment, 741 yard pounds were required to turn

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132 square inches; in the second, it required 753 yard pounds to turn a slice of 126 square inches.

The work performed by this plow was entirely satisfactory. The furrow channel was perfectly cleared; the earth was thoroughly pulverized; the grass, weeds and stubbles were entirely buried, so that they could not possibly spring up again; the plow ran very truly, so that a boy could hold it, and, as will be seen on inspecting the table, it consumed very little power in proportion to the work performed. The workmanship throughout was excellent and conscientious, and the material was as good as wood and cast iron could make them.

We have no hesitation in awarding a gold medal to this plow.

As heretofore remarked, plow No. 69 has a stubble mould-board, for stubble plowing, as in Class IV; a skim plow, to be used in connection with the stubble mould-board, for sod and subsoil plowing, as in Class V; and a sod mould-board, for sod plowing, as represented in Fig. 118,—turning either lap or flat furrows by a change of cutter, and working from seven to ten inches deep.

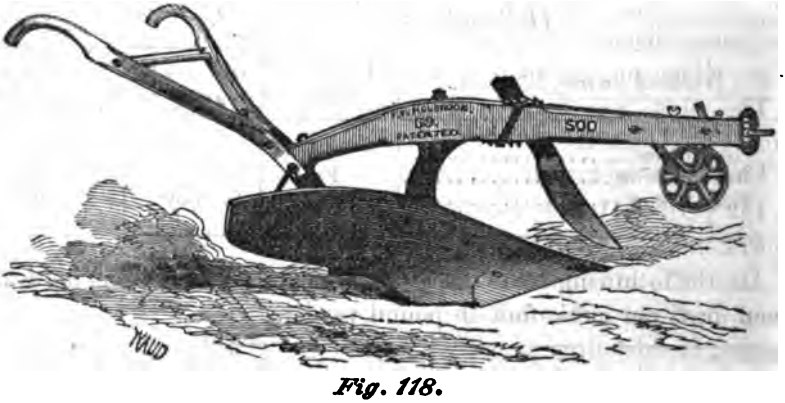

Fig. 118.

CLASS VI—SUBSOIL PLOW IN CONNECTION WITH AN ORDINARY PLOW.

The only entry in this class was by R. J. Wheatly, Du Quoin, Illinois.

Entry No. 6. Weight of attachment, 20 lbs. Price, $10.

This is intended to be affixed to any plow, and is not intended for any one in particular.

An ordinary clevis is affixed to the beam of the plow about one inch in advance of the standard. From the centre of the right side of the clevis a shaft extends 3¾ inches to the right. A plate of iron is bolted to the rear end of the beam, near the handles, 4 inches

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ong and 1¼ inches wide. A vertical projection descends from it 2 inches long. From this a horizontal projection extends 2½ inches; from the end of this a vertical plate descends 8 inches, and is perforated with five holes, 1 inch apart and ½ inch in diameter. A strong clamp on the right side of the standard is bolted to these holes, according to the desired depth of subsoiling. The stem hinges on the first mentioned shaft on the clevis, which is 16 inches long and 1 inch by ¾ inch. It passes backward, and is fastened by the clamp; it then bifurcates into two curved arms, 11 inches long and 8 inches apart at the rear extremity. A knife shaped like the letter U, but brought to a lancet-shaped point beneath, which is 13 inches below the bifurcated arms, and 3 inches wide, is fastened to the arms by two bolts. The upper arms of the knife are curved over towards the plow, having a slot in their extremities so as to change the angle at which it enters the ground at pleasure. The lower part of the knife is not in the same plane on both sides, the hinder part being an inch and three-quarters higher than the front edge; the soil dug up by the front edge is therefore raised vertically 1¾ inches, and falls the same distance back into the furrow channel from the back edge, which pulverizes it very well.

The plow was first tried alone, without the attachment for subsoiling, with the following result:

Furrow, 7 inches deep and 8 inches wide.

132 yards—Half power in pound yards, 34,600 pounds; actual power in yard pounds, 524 pounds.

After the attachment was applied, the furrow was ten inches deep, or three inches lower than before, which was therefore the amount of subsoiling actually performed. The power required to accomplish this work, viz., a furrow slice 7 inches deep and 8 inches wide, turned over, and 3 inches deep and 8 inches wide, pulverized at the bottom of the furrow, was 74 yards. 34,400 pounds half power in pound yards; actual power in pound yards, 876.

The power required, therefore, to subsoil three inches deep was 352 pounds, or 117 pounds for each inch that was subsoiled.

Mr. Holbrook's Sod and Subsoil, going in one inch deeper and taking a furrow three inches broader, absorbed 194 pounds less of power than did this of Mr. Wheatley's.

We were all very much pleased with the appearance of the invention and we confidently expected that a trial would demon-

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strate its usefulness; but in the face of the facts disclosed by the trial we were reluctantly compelled to withhold a testimonial of the approval of the Society.

CLASS VII—A DITCHING PLOW FOR OPENING DRAINS.

It will be seen by the list of entries that A. P. Routt, of Somerset, Va., was the only competitor, while the premium is awarded to N. Hawks, of Maine. Mr. Routt has addressed a protest to the board of judges, and it is acknowledged that the award was an improper one.

The blame of this transaction rests wholly on the shoulders of the chairman of the board of judges, whose duty it was to see that every implement competing for a prize was properly entered in the class for which it was competing. On account of sickness in Mr. Routt's family his plow was tried out of its regular order so that he might go home. Mr. Hawk's plow was tried in the regular order, and Mr. Routt was therefore not present to challenge his right to do so. The chairman having seen his name on the entry list supposed it was quite right, and permitted him to make the trial, without actually looking, as he ought to have done, to see whether this was the class for which he had entered. The mistake was not discovered until the premium was awarded, and after this it was of course impossible to withdraw it.

The ditcher consists of a double mould-board plow, which makes the ditch, and is followed by a roller formed of two cones united by their bases, which are two feet in diameter, the axis being 13 feet long. Two wrought iron arms proceeding from the rear of the plow frame and extending laterally and backward embrace each end of the axis, and draws the cones after the plow which pack and smooth the side of the ditch. After seeing it work, we did not think that it was a desirable implement for the farmer, and we should not, therefore, have awarded a premium to it under any circumstances.

The ditching plow of Mr. Hawks is one part of a machine which may be employed for various purposes. It can be used as a ditching plow, a cultivator, as a seed planter and a potato digger. Weight of the whole combined machine 180 pounds. Price, $50. We took a memorandum of the weight and price of the ditching plow alone, but it is now obliterated, and therefore we are unable to give it.

Considered as a seed planter, it may be described as a double

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mould-board plow cast in two pieces, viz.: the point and shares, and the wings or mould-boards. The beam is of oak, and is 45 inches long. The wheel, which is attached in the same way as Gov. Holbrook's, which we have already described, is 7 inches in diameter and 2 inches broad. The clevis is the same also as Gov. Holbrook's. A pair of cast iron arms rise from the upper edge of the mould-boards on each side, 9 inches to the rear of the breast, in a curved direction towards beam and bolt, through its heel. These arms descend six inches, and are flanged below. From these flanges a box is supported in which are inserted the gudgeons of the driving wheel, which can be raised or lowered at pleasure. The driving wheel is 11 inches in diameter and 1 inch wide. Two pins are inserted on each side of the driving wheel, which strike on cones which communicate a vibratory motion to the slides, which open the valves for the deposit of the seed. By increasing the pins, the quickness of the vibrations and consequently the amount of seed sown is increased; by diminishing the number of pins, the quantity sown can be diminished. A pair of hinged ears, 8 inches above the sole of the mould-boards, project in the rear of the handles, from which brace-rods (half an inch in diameter) extend backwards 12 inches to the covering irons. Another pair of brace-rods extend from the first pair, at the front of the covering irons, upwards to the handles. Eighteen inches above the sole of the mould-board one end has a ring which embraces the first pair of braces, and the other is bolted to the handles. The covering irons are 1 inch apart behind and 9 inches apart in front, sloping to the right and left as they descend to the ground. They are 14 inches long, and are curved upward and backward from below. A rib is cast about the middle of the covers, 10 inches high in front and 2 inches high behind, which flare outward. A pair of ears are cast about the middle of the covers, to which a cross-rod is bolted, from the centre of which a standard rises, which is surmounted by a cross-bar; from the ends braces extend to the handles; on each side a thumb-screw, on the top of the standard, regulates the depth of the hill. A pair of eyes, 1 inch in diameter and ten inches apart, are screwed into the top of the beam; between these a wooden roller is inserted, from the centre of which a wooden bar runs laterally. A marker is placed at the end of this bar, which can be moved backward and forward, and secured by a thumb-screw at any point, so as to make the marks for the furrow at any

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required distance. A drawer vibrates at each motion of the slide, which regulates the egress of the seed. Two projecting pins in the downward channel play up and down and prevent clogging.

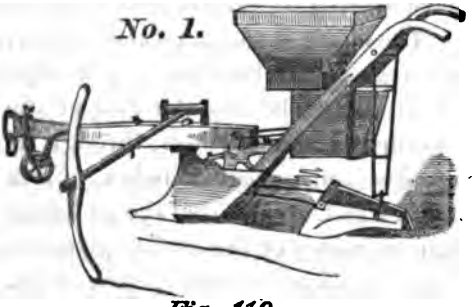

Fig. 119.

The description above given, in connection with the drawing, Fig. 119, will, we trust, give a tolerable idea of the implement when adjusted for planting seed.

When the boxes and planting machinery are detached it is converted into a horse hoe or cultivator, by hinging a bar from the rear end of each mould-board to which cultivator teeth are attached; these arms are expansible to any required width by means of a pair of wrought iron arcs, one of which is attached to the middle of each bar; they are perforated with holes, and can therefore be used to set the arms at any angle by thrusting a pin through these holes.

Fig. 120 shows the machine when used as a cultivator. When used as a ditcher, the coverers seen behind in Fig. 119 are reversed and hinged to the rear of the mould-boards by means of slots in the sides and screw bolts they may be raised higher as the ditch deepens. It really did excellent work as a ditcher, and by passing backward and forward a few times a single horse would cut out a very neat ditch with very little labor and great neatness of execution. We deemed its work much better than Routt's in all respects.

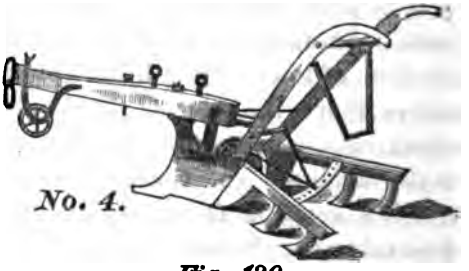

Fig. 120.

CLASS VIII—A MACHINE FOR EXCAVATING DITCHES FOR UNDER-DRAINING.

There was only a single entry in this class, which was made by E. Heath, of Fowlerville, N. Y.

We have mislaid our notes of the weight and price of this machine, or we neglected to procure them. Some idea of the machine will be obtained by an examination of the annexed

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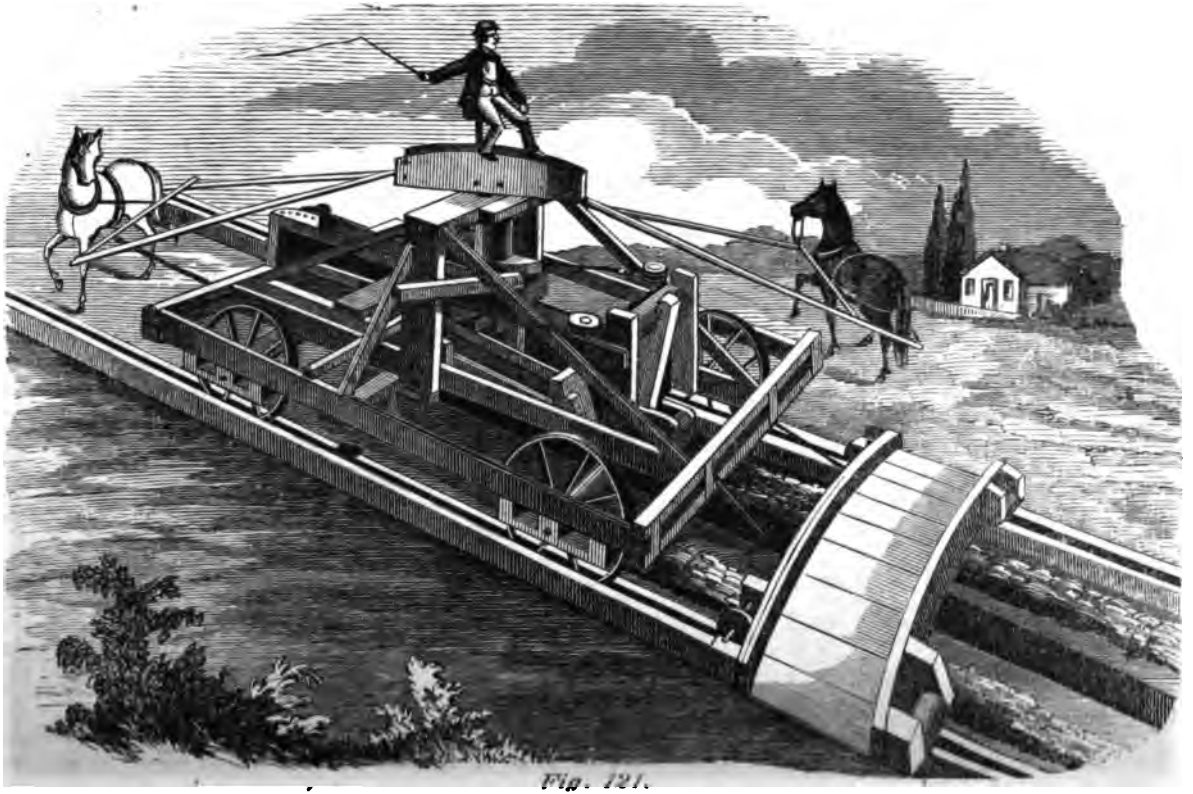

Fig. 121.

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Fig. 121. It runs upon a light wooden railroad, or rather tram road; as soon as it has passed over one pair of rails they are taken up by an attendant and replaced in front of the machine. What is called the shovel is more like a chisel which enters the ground diagonally. It is moved forward by means of a chain which is anchored to a stake at some distance ahead, and the other end is slowly wound round a pulley which revolves on the machine. The shovel runs down to the bottom of the ditch at each plunge, and raises the earth to the surface, where it is caught by the scrapers, by which it is removed about two feet from the sides of the ditch. The power required to operate the machine is two horses, a driver, and a man to remove the rails, or an expert man may do both. It will cut a tile drain at the rate of from four to six rods an hour in ordinary ground. It cut a ditch in our presence, in a very adhesive clay soil, two feet deep, taking out six lineal inches at every revolution of the sweep; while doing this it was worked with only one horse and one man. It appears complicated on looking at the figure; but it is in reality very simple. There is not a single geared wheel used in its construction; it can all be made by any blacksmith or carpenter, and if anything breaks it can be repaired in any village in the country. There are only 100 pounds of castings used about the whole machine, and any one that is competent to run a mowing machine or a threshing machine will have no difficulty in operating this one.

We were unanimously of the opinion that this machine is very far in advance of any contrivance for the excavation of ditches that we have ever seen, and that it is a practical, economical and useful implement which is greatly demanded at the present time. We do not doubt that its proprietors will be enabled to simplify and improve its details, and to strengthen some of its parts; but in our judgment the principle is a good one, and will meet the approbation of the increasing number who desire to increase the products of their farms by underdraining. We therefore award to it a gold medal.

CLASS IX—A STEEL PLOW FOR ALLUVIAL AND UNCTUOUS LANDS.

The only plow entered in this class was that of Collins & Co., of New York.

Plow C, No. 3. Entry No. 4. Weight, 90 pounds. Price, $25.

There was no land in the vicinity of Utica which was adapted

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for an actual trial of this plow in the kind of land for which it was specially intended; but from the trials which we made in adhesive soils, from a study of its shape and a test of the material of which it was composed, we had not the shadow of a doubt of its admirable adaptation to work in this kind of soil with entire success, and therefore awarded to it a gold medal.

CLASS X—A SWING OR SIDEHILL PLOW.

Two entries were made in this class, viz.: F. F. Holbrook, No. 6, Swivel Plow; weight, 136 pounds; price, $20. Lyman D. Burch, Sherburne; weight, 110 pounds; price, $15.

The plow made by Mr. Holbrook is laid out by an exceedingly ingenious process, with which we were made fully acquainted, but which we cannot make public, as it is not patented. We exceedingly regret the necessity for this enforced reticence, as the diagrams given in full would elucidate very clearly some important points in the general theory of the plow, and in the special theory of swivel plows, which we think are at present very ill understood by the users of plows. A very good idea of Mr. Holbrook's plow will be obtained by an examination of the annexed Fig. 122.

Fig. 122.

It, like all other swivel plows, consists of a half of two mouldboards combined in one; but, unlike others, it is so combined as that the one-half shall help the other all the way from the zero line forwards, so that a full sized furrow slice may be properly turned. It worked well in all respects, was very strong, and was thoroughly well made in all its parts. It pulverized the ground very thoroughly, and buried the weeds very well. Its chief

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characteristic was its pulverizing power, and the soft, velvety feel of the furrows under the foot which had been plowed with it.

Burch's plow was a very peculiar one, and was quite novel in its construction. The leading ideas sought to be embodied in it are lightness, strength and cheapness. We have no drawing of this plow, but will try to describe it as well as we are able. The beam is of cast iron, strengthened by a frame work of wrought iron rods. A hook cast on the rear end of the beam holds a brace. An iron bar, six inches in advance of the hook, projects laterally on each side of the beam, another bar of the same size is placed on the front end of the beam. One-half inch rods are stretched between these cross-bars, parallel to the beam; are carried round through the front bar, and connect in the middle 1½ inches from the front bar. At either end 1¾-inch hooks are inserted, which hold the head block to which the clevis is attached. One foot in advance of the first mentioned hook is a horn. Nineteen inches in advance is a pair of straps curving laterally outward, downward and backward. The coulter perforated through the shank is held by this rod passing the ends of these straps. The coulter can be shifted laterally on this rod, and the upper end catches in the horn on either side of the beam. The coulter is spatula-shaped, nine inches long and three inches broad, sharpened on both sides. We give a figure of share:

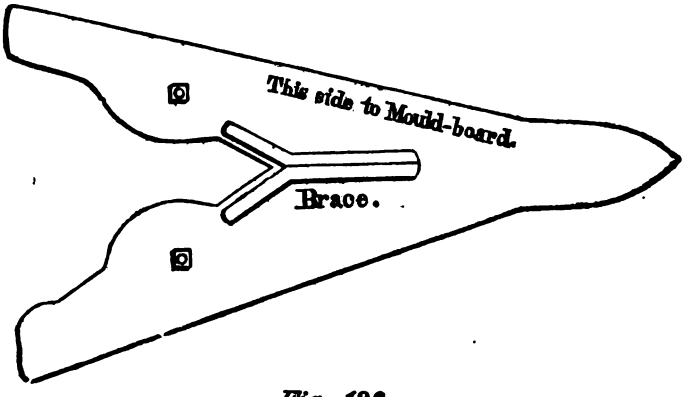

Fig. 123.

It will be seen that the share has on its under side a brace or strengthener of the point which is cast with it. It extends through a slot or cavity of the mould-board, back along the two wings or prongs of the point, its object being to give strength to the point and allow of its being made of hard iron, which makes it much

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more durable. It is difficult to describe the mould-board, which is of no regular figure. It approximates in its general outline to a cone, but has been pared away at different points to suit the views of the maker, and to adapt it to what he conceives to be the wants of the farmer.

The distance across, from the land side to the point of the feather, is 10½ inches. The length from the point of the plow to the point of the feather is 14 inches. Length of the land side, 23½ inches. From the point to the standard is 15 inches.

It worked very easily, and was very strongly made, and was of durable materials. Its great defect was a want of pulverizing power; the earth was hard after being plowed.

The judges decided as follows between these two plows:

First. Pulverizing power: Very greatly in favor of Holbrook's.

Second. Non-liability to choke in stubble: Equal in this respect.

Third. Lightness of draft.

PLOWS.	FURROW.		DRAUGHT.		AVERAGES.	
	Width, inches.	Depth, inches.	Actual.	Per cubic foot of earth.	Actual.	Per cubic foot of earth.
Holbrook's Swivel	12	7'	618	1,059	605	1,037
	12	7	593	1,015		
Burch's Swivel...	12	7	507	869	510	875
	12	7	514	881		

At a subsequent trial of their draft, side by side, in soil as nearly alike as possible, Holbrook's average draft was 502 pound yards. Burch's average draft was 432 pounds. In the first case, Buch's was lightest by 95 pounds, or 15.7 per cent. In the second case he was lighter by 70 pounds, or 13.9 per cent. The merit of lightness of draft was therefore awarded to Burch.

Fourth—Ease of holding: Decided in favor of Burch.

Fifth—Durability: Both equal in this respect.

Sixth—Cheapness: In favor of Burch.

Seventh—Excellence of mechanical work: In favor of Holbrook.

Eighth—Excellence of material: Both equal in this respect.

Ninth—Thorough inversion and burial of weeds: Holbrook.

Tenth—Even distribution of wear: Holbrook, slightly.

Eleventh—Regularity or trueness of turning: Holbrook.

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It will be seen that five of these points were decided in favor of Holbrook, three in favor of Burch, and in three points they were judged to be equal.

On this state of facts the question was discussed which was entitled to the medal, and the question finally turned on the comparative merits of easy draft and thorough pulverization. One portion of the judges held that if Holbrook consumed more power he did the most work; that is, he did that which it was the object of plowing to accomplish, viz., thorough pulverization, while Burch did not. Others contended that the greater ease of draught of Burch's plow entitled him to the premium. On a division it was found that four of the judges were in favor of awarding the premium to Holbrook and four to Burch. After a full reconsideration the vote remained the same, and therefore no premium can be given in this class.

In point of cheapness Mr. Burch's plow was very remarkable. The following statement shows the cost of each part:

Plow beam.....	37	pounds.	Casting,	6	cents.....	$2 22
Handle yoke.....	5	"	"	6	"	30
Crotch.....	4	"	"	6	"	24
Roller.....	5	"	"	6	"	30
Coulter guide.....	2	"	"	6	"	12
Mould-board.....	19	"	"	5	"	95
Shoe.....	7	"	"	5	"	35
Point.....	6	"	"	5	"	30
Wheel iron	5	"	.....			30
Whole weight.....	90	"	.....			$5 08
The whole cost of the plow complete.....						$10 00

HARROWS.

Only one class of harrows was made in the programme of the Society, and only two were entered for competition, viz.:

J. E. Morgan, Deerfield, Oneida county, N. Y. Weight, 200 pounds. Price, $30.

The extreme width of the harrow is 7 feet 4 inches. Its extreme length is 5 feet 3 inches. It has 48 teeth three-fourths of an inch square and 5½ inches long below the lower surface of the frame, which are steel pointed; a bolt passes through the frame behind each tooth to prevent splitting. It is made in two separate pieces, rectangular in form; each of the pieces has two huge bolts passing through all its bars, secured by a nut on the outer side of the outer bar; these huge bolts are furnished with

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an elongated eye, C D E F, the axis of which forms an angle of 20° with the vertical line, the upper end of the eye being directed to the opposite harrow; these eyes are connected by a three-quarter inch iron rod, A B, running through them. By this arrangement a backward and forward motion to the extent of nine inches, and an upward and downward motion to the extent of six inches is allowed to each side of the harrow, which adapts them admirably to work in rough and uneven ground. The draught is taken by rods hooking over a bar of iron between the two inner beams two feet long, vibrating on an iron arc of a circle having a chord of 32 inches. These rods run back to hinge on the third tooth of the harrow. The evener is attached by a link to one end, and by a chain to the other 18 inches long. The chord of the right arc is 25 inches. The frame of the harrow is made of white oak. The wooden bars are 2¾ inches square and 8½ inches apart. The tracks of the teeth are 4 inches apart. It is drawn diagonally.

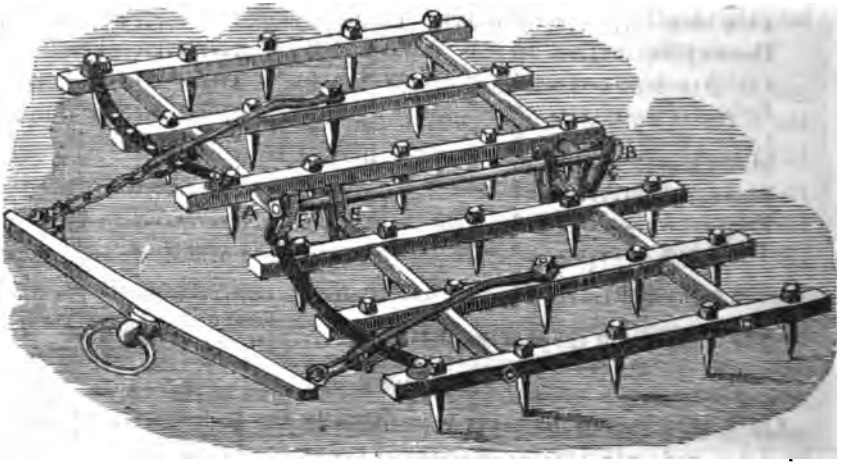

Fig. 124.

The draft of this harrow over ground which had been previously harrowed was 314 pounds; over ground which had *not* been previously harrowed, 371 pounds.

The harrow is made in the best possible manner, the materials are of the best quality, and the workmanship is most thorough and conscientious throughout. It will be seen from the description given above that it has a wide range of self-adjustment and self-adaptation, and is easily kept clear of weeds and other accumulations. The teeth track very well, no one tooth in

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ordinary circumstances following in the track of the other. It is a most excellent instrument in all respects, and we were unanimously of the opinion that it deserved the gold medal.

The other harrow was entered by F. Nishwitz. Weight. 250 pounds. Price, $40.

It is exceedingly ingenious in its construction; and if not entirely unique, we have never met with any similar one, nor have we met with any description of anything resembling it.

It consists of two expansable arms, hinged in front and contiguous to each other. They are expanded behind to any desired width by circular arms springing laterally and inwardly from the main arms at a point 2½ feet behind the angular point. These pass one above the other, and are secured at any desired expansion by a pin thrust through them both. The main frame is of oak, 8 inches wide and 2 inches thick. It runs on wheels 20 inches in diameter and 2½ inches wide, which are placed on a crank axle, the arms of which are 5½ inches long, and which regulate the depth.

The cutting action of this implement is by a series of rolling plates attached to each arm of the harrow. These plates are in the form of hollow segments of a sphere; the length of the chord is 11 inches, and the versed side ¾ inch. They are made of gray iron chilled on the edge, which is quite sharp; the convex side is turned outward. Seven of these concave plates are attached to one of the expanding arms, and six to the other. There is a socket attached to the center of each plate, upon which it rotates. A hollow cone, the opening at the base being 2½ inches in diameter, and having a flange which is ⅝ inch wide, is placed on the lower side of the expanding arms; an eye-bolt passes through the cone, which is fastened by a nut on the upper side of the arms; the eye fits into shoulders cut in the lower part of the cone. A steel pin from the eye projects inward, upon which the socket of the plates run; on the outside a scraper is attached to the under side of the oak arms, which takes off the adhering earth from the convex surface, and also prevents the plates from running off the steel pins upon which they rotate. They can be moved on a slot 1¼ inches backward and forward. The plane of rotation of the plates make an angle of 15 degrees with the line of the harrow's motion.

The effect of this machine as a pulverizer was most astonishing. It worked most effectually diagonally across the furrows, going

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across in this way and returning at a reverse angle, so as to cut the furrow diamond wise, reduced it to powder like flour. It also worked most admirably in scarifying sod. It makes one of the most perfect implements that can be imagined for mellowing the surface of moss bound meadows, and for scarifying meadows and pastures where the grass has run out, which it is desirable to re-seed without plowing.

We did not test among lumps and clods, but it was very evident from its mode of action that it would be a most effectual mode of breaking these down, and it will probably prove a better implement for this purpose than Crosskill's clod crusher, or any of the numerous imitations of that implement with which the market abounds. It is also admirably adapted to working fallows. It is not well adapted to level uneven land or to cover seed. In these respects it would not answer as well as Mr. Morgan's; but as a superficial pulverizer we cannot speak too highly of it. As it is designed to meet a difficulty in practical husbandry which no preceding machine accomplishes as well, we recommend to the Executive Committee to award a special gold medal to Mr. Nishwitz for this invention.

CULTIVATORS.

CLASS I—FOR CORN AND ROOT CROPS, BEST ONE-HORSE CULTIVATOR, ONE ROW.

There were two entries in this class, one by Alden & Co., Auburn, and by N. Hawks, Appleton, Maine. The weight of Alden's machine is pounds. Price, $12.50.

The frame, A B C D E F G H, Fig. 125, with various additions and substitutions, is made to accomplish a great variety of services in practical husbandry, as seen in Fig. 125. It is used simply as a cultivator for ordinary purposes. The thills, A B and C D, are of white ash; as seen in the figure they are 22 inches above the bars, E F and G H, but may be raised or lowered 1½ inches. The upright and diagonal braces are of hoop iron; the bars of oak. The teeth are of steel; the hind tooth is in the form of a double diamond, the three front ones are half diamond. The teeth are reversible, so as to throw the earth to or from the row. Throwing the earth from the row he went within an inch of it. The piece of ground assigned to him for trial was excessively weedy. On going twice over it, it was thoroughly

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cleared of weeds, and the ground was well mellowed two inches deep. It is converted into a marker for planting corn by taking off the four teeth and bolting a bar long enough to mark three rows on the under side of the arm, G H. It is shown as a corn-marker in Fig. 126. The teeth are wood, and their action will be understood by an inspection of the figure. Pegs, not shown in the figure, are driven diagonally into the upper corners of the cross bar, which support weights when it is desired to press the markers deeper into the ground. It is arranged as a quack rake by inserting fifteen teeth curved forward in an arm similar to the potato marker. The price of these teeth is $2.25.

For hilling corn, a diamond tooth is placed in front, having expansible wings. Two other teeth are placed at H and G, which throw the earth towards the corn.

To cover two rows of potatoes, four small plows, with long wings (it takes twenty minutes to make this change) are screwed on to the arms of the machine. With this arrangement the potatoes were covered in going backward and forward, raising a ridge 4 inches high.

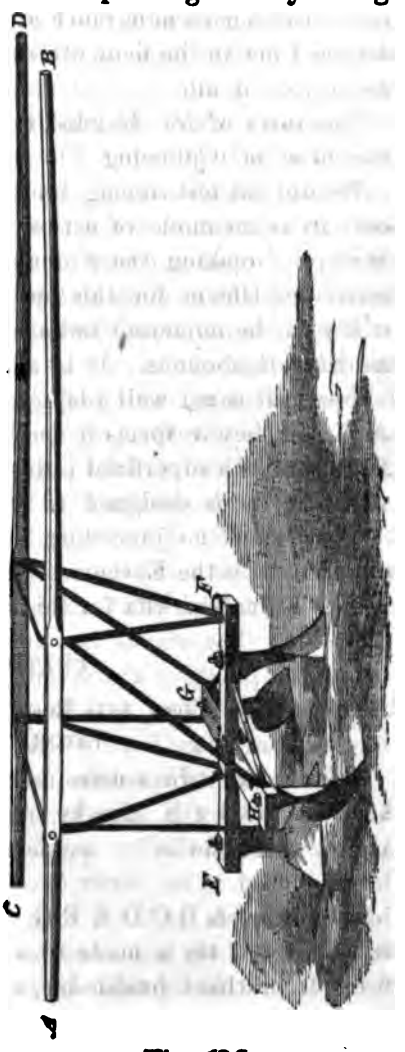

Fig. 125.

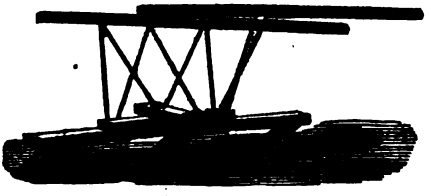

Fig. 126.

In a word, this machine cultivates between the rows in the usual manner. It marks furrows for corn, potatoes, or any other crop requiring to be planted in straight lines; rakes quack or other roots out

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of the soil, leaving them in rows upon the surface. It makes the furrows for any crops requiring to be planted in hills, and covers them, ridging them as much as is required. It was tried by very severe tests in the most difficult soils and circumstances, and did good work in all.

The work of Mr. Hawks' machine has been described under the head of "Ditching Plows," in Class VII, as a seed-planter, cultivator, potato-digger, etc. As the two machines were entered only as cultivators, we can only compare them strictly as such. We are of opinion that Alden's Cultivator cut up the weeds, and mellowed the ground, and performed the legitimate work of a cultivator better than Hawks, and we therefore award it the gold medal in this section of Class I.

For the same section of Class I, only one entry was made by A. L. Brierly & Co., of Trenton, N. J., who entered Phifers' Improved Wheel Corn, Cotton and Potato Plow and Cultivator, which is represented in Fig. 127.

The diameter of the wheel is 4 feet 6 inches; length of axle or distance between the wheels at their maximum separation is 5 feet 4 inches. The axle is of wrought iron, 1⅜ inches in diameter. The wheels may be run together by means of a sliding collar and pinching screw, so that their distance from each other will be only 2 feet 6 inches. They may be made to take any intermediate place between these maximum and minimum points.

Four wooden bars seen in the figure, each 21 inches long, are adjusted over the axle by a circular clip, the shank of which passes through the bar and is fastened by a nut. A slotted iron bar is bolted to the inner ends of each pair of bars. A vertical bar, with slots in both directions, is bolted to each bar just in advance of the axle, and secured by fangs on the top and bottom; from this vertical bar and jointed to it a lever extends backwards 2 feet 7 inches, and 1 foot 10 inches downward. It is curved downward at its lower end, and slit so as to embrace the head of the plow or cultivator tooth.

A projection extending backward at an acute angle receives a brace, which hinges on a bar below the lifting lever, as shown in the cut. The brace is perforated by nine holes, which are keyed to the projection from the curved end of the lever; the inner end of the lever is adjusted by a rod and screw running through the wooden bars. The cultivator teeth are fastened to the lever by an iron bolt and wooden pin. If the plow or cultivator tooth

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Fig. 121.

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encounters any sudden strain, the wooden pin breaks at once, and its connection by the bolt leaves it simply as a loose joint, and takes off all the strain until the obstacle is passed.

It will be seen by a careful study of this arrangement that it provides for a very wide range of adjustment. The wheels may be set at any distance apart by raising or lowering the curved levers in the slots of the vertical bars. The plow points may be made to take more or less depth by means of the lifting lever. Any one or more of the plows can be lifted from the ground, either wholly or in part, by the holes at the slot ends of the curved levers; they can be lengthened or shortened, and the plow can be made to go as deep or as shallow as is desired.

There is a semicircular arch shown in the figure, one end of which rests on the axle and the other on the slotted bars; it is furnished on the outer circle with notches. A thumb latch at the upper end of the lifting lever works a rod connected with a spiral spring, and permits a bolt to enter the notches, by which the teeth are raised out of the ground.

A convenient seat for the driver, resting on a steel spring, is seen in the figure. An arm projecting laterally can be bolted to the end of either of the curved levers, by which the number of plow or cultivator teeth can be increased at pleasure.

The machine is also provided with a steering apparatus. An iron bar is bolted to the under side of the axle, having a circular disk in the center, in which is a circular slot. The pin of the tongue is inserted in the slot, but is fastened by a bolt kept in place by a spiral spring. When the spring is raised by a lever the tongue has a motion of rotation to the extent of the circular slots. An iron bar 1 foot 4 inches long projects from the tongue on each side, and a chain passes from either end of it to the ends of the under bar. A lever can therefore change the angle of the tongue with the axle at pleasure. The machine was tried in all the operations that it professed to perform, although we could only consider it officially as a cultivator.

It first operated as a seed-sower, scattering rye very evenly, and covering it with four plows running shallow and turning the earth all one way. Next it worked with seven cultivator teeth, throwing the earth in opposite directions. It cultivated two rows of corn, one plow on each side throwing earth towards the corn and one throwing it away from it. Again, all the plows threw earth towards the corn, and then both threw it away from it.

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The changes to accomplish these different objects can be made very easily; in no case did it require more than six minutes for that purpose. It did all the work, and went through all the tests to which it was subjected in a very perfect manner. It worked close to the corn rows, and, by means of the steering apparatus, it could be made to move around a hill or a single stalk which happened to stand out of line, without injuring it or touching it. It destroyed the weeds very satisfactorily, and it was tested in as weedy a patch and as tough a soil as we ever saw. It pulverized the soil as well as could be desired. The only fault that we noticed in the whole course of the protracted trial which we gave to it was that, in some very bad places, it clogged somewhat. It is very strong in all its parts, and we think it is not liable to get out of order. The material is very skillfully distributed, the greatest amount of material being distributed to the parts where the strain is greatest.

We award the gold medal to this machine in the second section of the first class.

CLASS II—FOR MELLOWING SOIL AND KILLING WEEDS.

Ford & Howe, of Oneonta, N. Y., entered for this section of Class II. Weight, 480 pounds. Price, $60.

The drawing, Fig. 128, will give a very clear idea of its construction. The evener A B swings on the under side of the tongue, from the evener iron bars run backward diagonally to a little beyond the middle of the bars of the frame from which the cultivator teeth are suspended; hence, although the horses are hooked to the end of these bars, neither horse can pull more than another, their action being equalized by the evener as in the common whiffletree. It will be seen that a brace runs forward from about the middle of each shank of the tooth, and bolts into the bars of the frame. There are several holes pierced through these bars near the lower end; by changing the pins through these bolts a greater or less angle can be given to the plane of the teeth as they enter the ground. The tongue has an opening in the middle, from D to E, which enables the driver more easily to strike a straight line. It can rotate from right to left around the pin C. There is a friction wheel on the under side of the tongue, which rolls on the iron arc G. The driver, seated in the chair, with a foot on each of the outer bars, carries himself to the

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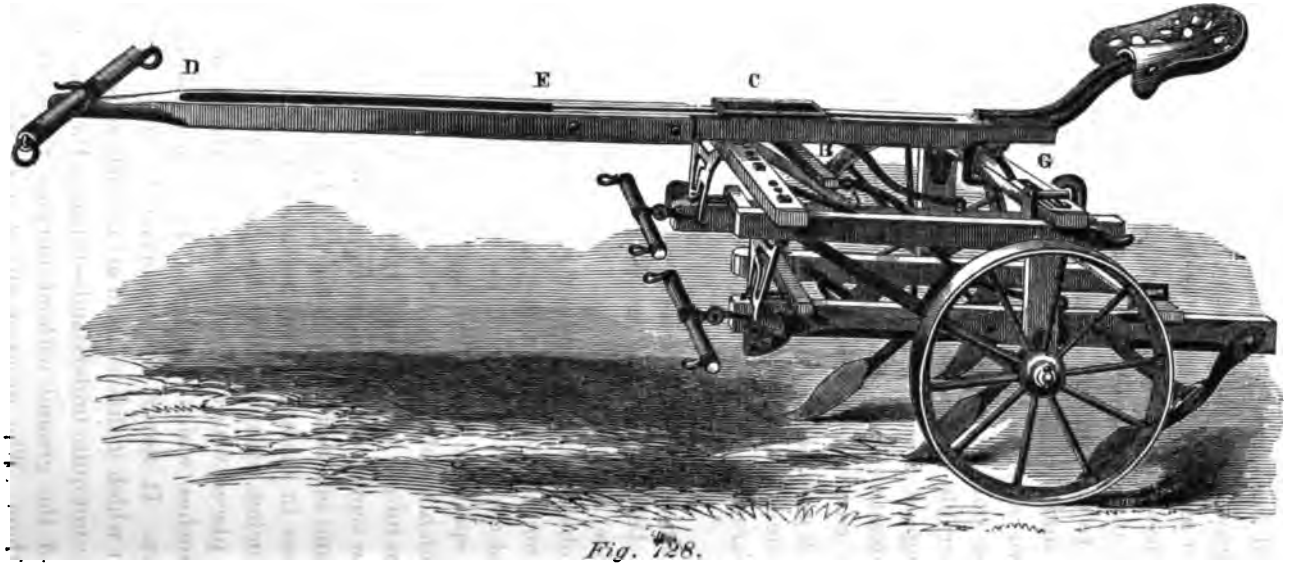

Fig. 128.

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right or the left, as he chooses; he thus turns the machine at his pleasure, and avoids any plant which may stand out of the line. By means of a crank not seen in the figure, the teeth may be entirely lifted out of the ground or made to run deeper or shallower. By drawing out the pin at E, the tongue may be turned on the other pin as pivot. By this arrangement it is stowed away when not in use with much economy of space. The blades of the teeth may be turned from the right to the left so as to throw the earth either to or from the corn. Where used as a gang plow, three beams and three rows of teeth are used; for cultivating in corn only two sets are employed. It does its work extremely well, and the only objection to it that we observed is that it takes considerable time to make the changes, viz.: twenty minutes to change it from a gang plow to a corn cultivator, and twelve minutes to change the angle of the teeth so as to throw earth to the corn when it had been throwing it away from it. We award it a gold medal in this section of the class.

In the second section of Class II, William H. Burtis & Co., Maltaville, Saratoga county, entered McQueston's Improved Cultivator.

This implement will be understood by an inspection of the annexed Fig. 129, without any further description. Weight, 100 pounds. Price, $35.

It will be observed that the point of each spade has a horizontal range of nine inches on the diagonal rod which passes through the shank just above the base of the spade. Each of the beams to which the spades are attached work freely on a centre at the front end, which enables the attendant to raise out of the ground or press them into it at pleasure; they also have a lateral range of a complete semicircle. The wrought iron arch in front is two inches wide and one-half an inch thick. The wheels are of cast iron, 14 inches in diameter by 2 inches wide. The shovels are of steel, 5½ inches wide and 10 inches long. The work was well done in all places where it was tried; it stirred the soil to a depth of 6 inches, which was about 1½ inches deeper than any of the others. It never was observed to clog. It has one peculiarity in which it differs from all the others, which we must confess we do not quite understand—it leaves the grass and weeds on the top of the ground without burying them, while all the others bury them. The greatest objection to it is that it makes

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very hard work for the attendant. Where a machine is desired to be regulated by handles and without permitting the attendant

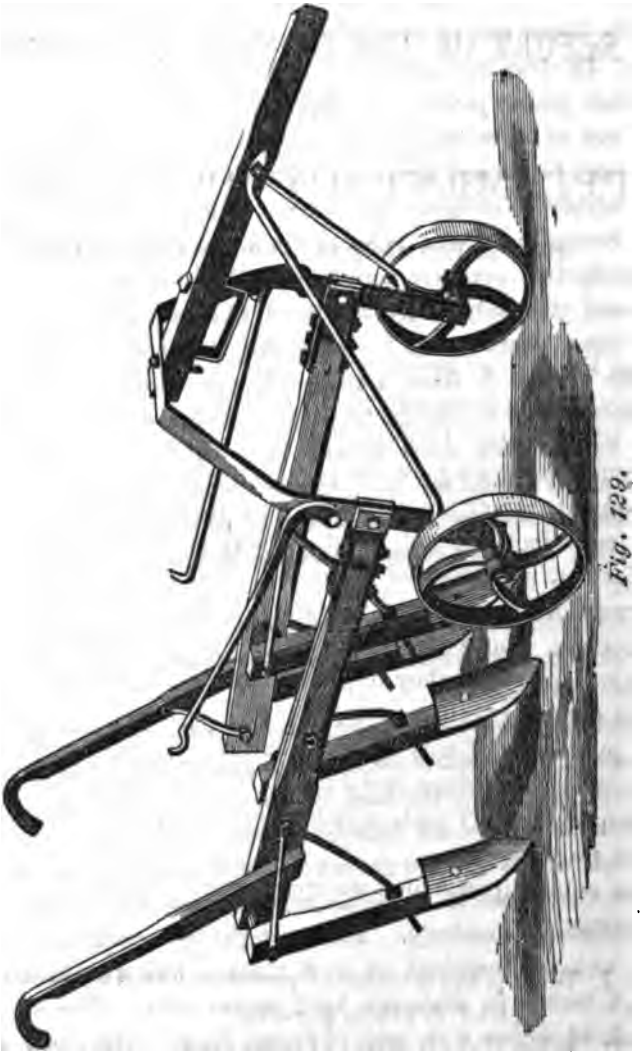

Fig. 128.

to ride, this machine can be confidently recommended. We award the gold medal to this section of the class.

JOHN STANTON GOULD,
ELISHA R. POTTER,
PETER CRISPELL, JR.,
HENRY WATERMAN,
B. P. JOHNSON,
SANFORD HOWARD,
JOSEPH McGRAW.

NOTE.—Mr. Conger was not present at the trial. Mr. Geddes was only present for a single day, and took no part in the decision. Prof. Pierce declines to have his name appended to the report, as he does not concur in some of its statements.

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REPORT OF THE SPECIAL COMMITTEE

ON THE

SUPPLEMENTARY PLOW TRIALS,

Held at Brattleboro', June 2, 3 and 4, 1868.

THE Executive Committee of the New York State Agricultural Society, having been informed by the report of the judges of the plow trial instituted by the Society at Utica, last year, that, from accidental circumstances, they were unable to complete the trials necessary to ascertain the facts in relation to the plow and its working, which were of great importance to the plow-wright and the farmer, it appointed a special committee, consisting of the chairman of the board of judges and the consulting engineer of the Society, who were requested to complete the trials at such time and place as they might deem most desirable in order to obtain correct results.

In pursuance of this appointment, they fixed on Brattleboro', Vermont, as the place, and June 2, 1868, as the time for obtaining the supplementary facts which were necessary to the completion of the plow report.

The points upon which we endeavored to obtain light were the following:

I. What is the increase of power required for each successive inch of depth in plowing?

II. What is the increase of power required for each successive inch of width in plowing?

III. What is the increase of power required when the furrow slice remains of the same size for each successive increment of velocity?

IV. What proportion of the total amount of power consumed in plowing is absorbed by the different parts of the plow, viz., the land side, the share, the mould-board?

V. What is the influence of the coulter on draught?

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VI. Does the skim-plow consume more or less power than the coulter?

VII. What is the elasticity of different soils?

VIII. What is the influence of the wheel on draught?

IX. What is the influence of the plowman on draught?

We had ascertained by previous trials that one furrow varied very greatly in tenacity from another lying closely contiguous to it, and this difference was so great that it sometimes required a force of three hundred pounds to overcome it.

It was, therefore, in our judgment, of great importance to obtain a piece of land for the trials as homogeneous as possible in its texture and as free from local obstacles, such as stumps, stones and roots, as could be obtained. In order to guard against interruptions from continuous rainy weather, it was desirable to select land which drained easily and rapidly. The lands on the Connecticut river, near Brattleboro', met these conditions more nearly than any others with which we were acquainted, and the trial was accordingly appointed for that locality.

The plowing was done on the meadow belonging to the Brattleboro' Lunatic Asylum, which lies about ten feet above the summer level of the Connecticut river, but which is often entirely covered by the spring floods. The soil is a sandy loam, somewhat stiffer than is usual in that class of lands, and very full of micaceous scales. It has been in sod for twelve years past; the grass, which was chiefly blue grass, *poa pratensis*, was very thick upon the ground, and the roots were tough and thick. In some of the furrows there were found thick masses of quack roots (*Triticum repens*); in others there was a great deal of hardhack (*Spiræa tomentosa*); in some others, both kinds of roots were combined. Although the general appearance of the meadow was level, yet it was nevertheless considerably rolling, and it was found that there was considerable difference in the draught of the furrows which were turned so as to fall down hill or up hill.

As examples of the differences thus caused, we refer to the seventy-second experiment, where the furrow was turned down hill, and the seventy-third, where it was turned up hill; the difference in draught being 76 pounds in favor of the down-hill furrow. The same result is also exhibited in the seventh-sixth and seventy-seventh experiments, where the difference was 96 pounds. The difference between the seventy-fourth and seventy-

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fifth experiments was 136 pounds, which was caused by the seventy-fifth being turned up hill, and also to the roots of the hardhack, which varied from one-eighth to three-eighths of an inch in diameter. The soil was very moist from recent copious rains.

Governor F. Holbrook was kind enough to procure for us the various plows, with the necessary adjustments required for the trial; and also, at our request, negotiated for the use of the land and for the the teams and assistants.

We obtained the assistance of Mr. Henry Brooks, of Concord, well known as a very skillful plowman, and his services as such were perfectly satisfactory.

Governor Holbrook, of Vermont; Governor Brown, of Massachusetts, and Mr. Joel Nourse, of Boston, the inventor of the well known Eagle plow, were present with us at all the trials, and their advice and assistance were of great value. Mr. G. Tucker, of the *Country Gentleman*, was also with us during the whole time.

We began our experiments with two horses, but finding it difficult to preserve a perfectly uniform breadth of furrow, owing to the irregularity of their walking, we used four horses, walking in pairs, so that the irregular walk of one team compensated for the irregularity of the other. Finding that four horses made the experiments so much more satisfactory, we continued the use of them throughout.

I. Experiments to determine the increase of power required for each successive inch of depth in plowing with

Holbrook's Swivel Plow, No. 4:

No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS.
1	6½	13½	494	
2	7	13½	611	This was probably a mis-reading of the dynamometer, and is rejected in making up the averages.
3	7	13½	557	
4	7	13½	575	Average of third and fourth experiments, with a furrow slice of the same size, 566 pounds.
5	7½	13½	584	

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Holbrook's Swivel Plow, No. 4 (Continued).

No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS.
6	7½	14	634	The average of the fifth and sixth experiments is 609 pounds. Although the sixth is half an inch wider than the fifth, the excess is chiefly due to the turning of the furrow up hill in the sixth.
7	8	15	641	Average of the seventh and eighth experiments, 651 pounds.
8	8	15	660	
9	6	12	482	Average of the ninth and tenth experiments, 469 pounds. The excess of draught of the ninth over the tenth was due to old bones which lay in the bottom of the furrow.
10	6	13	457	
*11	6	13	582	The work without the coulter was very poor; the furrow slice was torn and jagged; the furrows did not lap well; the grass was ill covered, and the pulverization was imperfect.
†12	6	13	504	Work good in all respects.
‡13	6	13	505	Average of thirteenth and fourteenth experiments, 502½ pounds.
14	6	13	501	

* The coulter was here removed, and the plow was worked, cutting the sod with the shin.

† The coulter was here replaced, but was set so that it only penetrated one inch into the soil.

‡ The coulter was here brought down within three inches of the sole of the plow.

This plow made the best pulverization at a depth of seven inches. It was slightly worse at eight inches; but at depths greater or less than these the inferiority of its work was very marked.

The average depth of the first ten experiments was 7.05 inches; the average breadth of the first ten experiments was 13.65 inches; the average draught of the first ten experiments was 565 pounds.

This average draught of all the trials agrees within one pound with the average draught of the third and fourth experiments, which correspond with it in the size of the furrow slice.

Recapitulation of Averages.

Inches.	Inches.	Pounds.	Differences, pounds.
6	12½	469	..
6½	13½	494	25
7	13½	566	72
7½	13½	609	43
8	15	651	42

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The average difference of draught for each half inch of depth is 45.5 pounds, or 91 pounds to each inch. The accuracy of this average is somewhat impaired by the fact that there is a difference in the breadth of the furrows, the extremes being 2½ inches apart.

We next began a series of experiments to determine the rates of draught to depth with Holbrook's Plow No. 69, with a coulter and sod mould-board:

No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS.
15	..	..	*118	Average of fifteenth, sixteenth and seventeenth experiments, 108 pounds.
16	..	..	*107	
17	..	..	* 99	
18	5½	16	647	Average of eighteenth and nineteenth experiments, 621 pounds.
19	5½	16	594	
20	6	18	540	Average of twentieth and twenty-first experiments, 545½ pounds.
21	6	18	551	
22	7	18	558	Average of twenty-second and twenty-third experiments, 588 pounds.
23	7	18	618	
24	8	18	626	Average of twenty-fourth, twenty-fifth, twenty-sixth and twenty-seventh experiments, 601 pounds.
25	8	18	603	
26	8	18	603	
27	8	18	578	
28	9	18	744	Average of twenty-eighth and twenty-ninth experiments, 767 pounds. In the twenty-ninth, the coulter obstructed by quack roots.
29	9	18	791	
30	10	18	800	In the thirtieth experiment the coulter obstructed by hardhack roots; in the thirty-first the coulter obstructed by quack and hardhack roots. Average of thirtieth, thirty-first, thirty-second and thirty-third experiments, 790 pounds.
31	10	18	871	
32	10	18	755	
33	10	18	734	
34	10½	18	876	Average of thirty-fourth, thirty-fifth, thirty-sixth, and thirty-seventh experiments, 1,012 pounds. This great draught was caused by the blunt shank and knee of the coulter running into the sod at this depth. They are retained in the table as instructive illustrations of the effect of a blunt coulter, but are rejected in making up the averages, which are taken from the eighteenth to the thirty-third experiments, both inclusive.
35	10½	18	1,215	
36	11	18	976	
37	11	18	1,080	

* Surface draught.

Average depth from eighteenth to thirty-third experiments, 7.94 inches; average width, 17.80 inches; average draught, 663 pounds; average prism, 141.33 square inches. Average prism from twenty-fourth to twenty-seventh experiments, 144 square inches; average draught, 601 pounds.

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In this series, with Plow No. 69, the average draught of the whole series exceeds the average draught of the series of experiments which agree with it in the size of the furrow slice by 62 pounds. (Experiments twenty-four, twenty-five, twenty-six and twenty-seven, eight inches deep and eighteen inches wide.)

Recapitulation of Experiments with Plow No. 69.

Average depth, of furrow, inches.	Average width, of furrow, inches.	Average draug't in pounds.	Difference, pounds.	Size of prism, square inches.
5½	16	621	..	88
6	18	545½	75½	108
7	18	588	42½	126
8	18	601	13	144
9	18	767	166	162
10	18	790	23	180
Surface draught, 108 pounds.				

The average difference in the draught of each inch in depth was 61 pounds. The excess of 75½ pounds of draught in the furrow of 88 square inches over the furrow with 108 square inches is anomalous, and was caused either by an error in reading of the dynamometer indication or by some local obstruction. The anomaly did not appear until the indications were computed, and it was then too late to ascertain the cause of it. This difference was not, therefore, included in the average of 61 pounds.

The next set of experiments to determine the rates of draught to depth was made with Holbrook's Plow No. 65, the coulter being adjusted to lay *flat* furrows:

No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS.
38	..	..	*77	
39	2½	11	324	Average of thirty-ninth and fortieth experiments, 326 pounds.
40	2½	11	328	
41	3½	11	404	Average of forty-first and forty-second experiments, 398 pounds.
42	3½	11	392	
43	4½	11	459	Average of forty-third and forty-fourth experiments, 439 pounds.
44	4½	11	419	

* Surface draught.

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No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS
45	5½	11	451	Average of forty-fifth, forty-sixth, forty-seventh and forty-eighth experiments, 448 pounds.
46	5½	11	463	
47	5½	11	428	
48	5½	11	424	
49	7	11	520	Average of forty-ninth, fiftieth and fifty-first experiments, 512 pounds.
50	7	11	504	
51	7	11	512	
52	8	11	574	Average of fifty-second, fifty-third, fifty-fourth and fifty-fifth experiments, 552 pounds.
53	8	11	545	
54	8	11	564	
55	8	11	528	

Average depth from thirty-ninth to fifty-fifth experiments, both inclusive, 5.64 inches; average width from thirty-ninth to fifty-fifth experiment, both inclusive, 11 inches; average draught from thirty-ninth to fifty-fifth experiments, both inclusive, 463 pounds.

The average draught of the whole series of experiments exceeds the average of the forty-fifth, forty-sixth, forty-seventh and forty-eighth experiments, which agree most nearly with it in the size of the furrow slice, by 20 pounds.

Recapitulation of Experiments with Plow No. 65—Flat furrow.

Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	Difference, pounds.	Size of prism, square inches.
..	..	*77	..	....
2½	11	326	..	27.5
3½	11	398	72	38.5
4½	11	439	41	49.5
5½	11	443	4	60.5
7	11	512	69	77
8	11	552	40	88

* Surface draught.

The average difference in the draught of each inch in depth was 45.20 pounds.

Experiments to determine the rates of draught to depth made with Holbrook's Plow No. 65, with a coulter adjusted to *lap* furrows:

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No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS
*56	8	11	485	The furrow was not of full width; not averaged.
*57	8	11	520	Average of fifty-seventh, fifty-eighth and fifty-ninth experiments, 545 pounds.
*58	8	11	557	
*59	8	11	558	
†60	8	11	515	Average of sixtieth and sixty-first experiments, 512 pounds.
†61	8	11	509	
62	8	11	452	Average of sixty-second, sixty-third, sixty-fourth and sixty-fifth experiments, 453 pounds.
63	8	11	458	
64	8	11	444	
65	8	11	459	
‡66	7	10	384	Average of sixty-sixth and sixty-seventh experiments, 422 pounds.
‡67	7	10	460	
68	7	10	370	Average of sixty-eighth, sixty-ninth, seventieth and seventy-first experiments, 389 pounds.
69	7	10	420	
70	7	10	390	
71	7	10	379	

* On examining the plow after it had been used in these four experiments, it was found that the coulter was excessively dull; it was, in fact, an unfinished one which had been put in inadvertently when the change was made for a lap furrow. A sharp coulter was then inserted.

† The coulter in these two experiments was very badly choaked with roots which collected across its edge. To remedy this the rake was very considerably increased.

‡ It was found that the coulter, in these two experiments, had slipped down so as to loose the extra rake which had been given to it, and the grass roots again gathered on its edge. More rake was then given to it.

The difference between plowing seven inches or eight inches deep, according to these experiments, is 64 pounds. The same plow showed a difference between seven inches and eight inches, when turning a flat furrow, of 40 pounds. (Experiments forty-nine to fifty-five.)

Experiments to determine the rates of draught to depth with Holbrook's Sod and Subsoil Plow No. 69, with a stubble mouldboard and a skim plow attached to the front of the beam:

The skim plow turned a furrow two and a half inches deep in all cases; the remainder of the furrow slice was turned by the main plow.

The column headed "Depth of furrow" indicates the whole depth turned by the skim and the main plow.

The point of the skim plow was eleven inches in advance of the point of the main plow.

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No. of experiment.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	REMARKS
72	9	12	621	Average of seventy-second and seventy-third experiments, 659 pounds.
73	9	12	697	
*74	10	12	733	Average of seventy-fourth and seventy-fifth experiments, 801 pounds.
*75	10	12	869	
76	11	12	800	Average of seventy-sixth and seventy-seventh experiments, 848 pounds.
*77	11	12	896	
78	12	12	947	Average of seventy-eighth and seventy-ninth experiments, 990 pounds.
79	12	12	1,003	
80	13	12	1,012	Average of eightieth and eighty-first experiments, 1,047 pounds.
81	13	12	1,082	
†82	14	12	966	Average of eighty-second and eighty-third experiments, 1,054 pounds.
83	14	12	1,143	

* Many stones in the bottom of furrow. † This was not quite full depth.

Average depth from seventy-second to eighty-third experiments, 11.5 inches; average width, 12 inches; average draught, 897 pounds.

The average draught of the whole series of experiments falls below the mean of 11 and 12 inches, which corresponds with it in size, 21 pounds.

Recapitulation of Experiments with Sod and Subsoil Plow.

Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	Difference, pounds.	Size of prism, square inches.
9	12	659	..	108
10	12	801	142	120
11	12	848	47	132
12	12	990	42	144
13	12	1,047	57	156
14	12	1,054	7	168

The average difference in the draught of each inch in depth was 59 pounds.

The work of this plow at all depths was very perfect; the ground was thoroughly pulverized; the vegetation was perfectly buried, and the surface was left smooth and level as a garden. There can be no doubt that the work was much better done than it could have been done by a spade.

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In making these experiments, several things interesting to the practical plowman were very fully exemplified:

1. *The unequal tenacity of the soil.* The plowing was round a centre back furrow. As the land grew wider the furrows, of course, receded farther from each other. While testing the sod and subsoil plow (seventy-second to eighty-third experiments), one of the furrows ran for half its length through a sandy soil, while the other ran through a moist, tenacious loam. The even numbers of the experiments mark the sandy furrows; the odd numbers the tenacious loams. The average draught of the loamy furrows is 102 pounds greater than the sandy furrows.

2. *The importance of a proper adjustment of the several parts of the plow.* The draught as indicated in all the tables given above is much heavier than it would have been if one uniform depth and width of furrow had been adhered to throughout. The change from one sized furrow to another, of course, involved a change in the adjustment of the plow, and this was not always ascertained on the first or even on the second trial. When this was not accurately done, the plowman exerted his strength at the end of a long lever to counteract the effect of the maladjustment, which was at once indicated by the index of the dynamometer, sometimes to the extent of 150 pounds. Some of the experiments were made by plowing two furrows, or once around; others by four furrows, or twice around. In most cases the two last furrows showed less draught than the two first, because the plow swam more freely and required less interposition on the part of the plowman. As examples of this, we refer to the forty-fifth and forty-sixth experiments, showing an averaged draught of 457 pounds, and the two next furrows of the same size, which only averaged 426 pounds, showing an advantage of draught amounting to 31 pounds, arising from more perfect adjustment. In these last furrows the plow ran for more than two-thirds of the distance by itself, without a touch of the plowman's finger, and for the remaining third his touch was the lightest possible. The same thing is shown by a comparison of the sixty-second and sixty-third with the sixty-fourth and sixty-fifth experiments, the latter being 35 pounds lighter than the former, for the same reason. The necessity of accurate adjustment was very clearly illustrated in the action of plow No. 69. We desired to adjust it for a furrow 12 inches deep and 16 inches wide, but Mr. Brooks, though perfectly acquainted with the implement, was utterly

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unable to make it take such a furrow; his utmost efforts could not force it more than eight inches into the ground, nor could it take a furrow wider than twelve inches. More than two hours were spent in trying to make it swim freely in the desired furrow, but without success, although Gov. Holbrook and Mr. Nourse, both eminent masters of the art of plowing, exerted all the resources of their skill to make it work. We all knew that the plow would work admirably in such a furrow, for we had seen it do it again and again. We broke off our work for dinner, quite in despair of being able to accomplish what we designed to do with that plow. While sitting at dinner, it occurred to Mr. Nourse that the difficulty might lie in the beam. Accordingly, on reassembling in the field, after dinner, we found that the workman had carelessly set the beam out of its true direction, so that it turned from land and out of the ground to such an extent that the clevis could not afford vertical or lateral motion enough to correct it. These tendencies were then counteracted by an opposite adjustment of the coulter to make it take more land, and by hooking the chain into the wheel guards to make it run deeper. We then had no difficulty in performing the experiments from the fifteenth to the thirty-seventh with *relative* correctness, although the *absolute* draught was undoubtedly considerably greater than it would have been had the beam been in its right place.

3. *The importance of skill in the plowman was also very clearly manifested.* This skill is desirable to hold the plow to advantage. Delicacy and sensitiveness of touch are almost as much required in plowing as in line engraving. The plow manifests its intention to go astray to the sympathetic plowman before it actually does so; a very slight, an almost inappreciable counter resistance on his part, promptly applied, will check the volition of the plow before it is manifested in action, but if the golden moment is lost, it is gone forever. The volition is manifest in action, and an unsightly alteration in the size of the furrow slice reveals the plowman's awkwardness to every spectator. But the skill of the plowman is not alone manifested in his manner of holding; it is even more clearly shown in his mode of tempering the plow. A good plowman is never satisfied until his plow swims absolutely free; he will not use any more of his own strength than is really necessary, knowing as he does that, as his force is exerted through levers, every pound of exertion which he uses reacts on the horses with a tenfold force. He will, therefore, alter his adjustments,

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if need be, twenty times until this result is fully accomplished. When the plow does not run level, but is frequently changed by the plowman from one side to the other, the two sides of the furrow slice will be found to be unequal in thickness, and, therefore, the soil of the thinner edge has been left undisturbed at the bottom. We found in *every case* that the *draught* of the plow was lightest when it was going smoothly and steadily by itself, untouched by the plowman. It was really interesting to watch its motions when running thus freely; if it encountered any obstacle in the soil, which had a tendency to throw it out, it would turn of its own accord to take more land, or if the obstacle directed it inward, toward the land, it would turn to throw itself out; and when it accomplished the object it would quietly settle down again to its level and proper work. It was truly automatic in its motions, but this was only so when the different parts were adjusted with *absolute* accuracy, which can only be done by an accomplished plowman. Seeing these facts brought out so clearly before our eyes, it was a cause of deep regret to us that the race of finished plowman was rapidly running out in the State of New York.

Our plows have been very greatly improved within the last quarter of a century; but the sons of farmers who were in the noon of their vigor at that time do not understand the art of plowing as well as their fathers did. We think that the State Agricultural Society could exert its great power for good in no direction where it would be more beneficial to farmers than in taking measures to stimulate a taste for good plowing among the rising generation of farmers in New York. The growing class in our State, who farm for pleasure as well as profit, might do much to encourage this taste. If they would adopt a high standard of plowing, and insist upon their workmen approximating closely to it, rewarding the closest approximations to it by a suitable pecuniary recompense, the *fashion* of good plowing would soon spread. Just as the fashion of skating has produced an abundance of elegant skaters, and the fashion of base-ball playing has produced an abundant crop of admirable batsmen, throwers and catchers, so the fashion of good plowing would supply us with first-class plowmen.

4. *The actual results of the trial.* These are shown in the following tables:

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Table showing the average depth and width of furrow, the average draught, the average size of prism, and the average of the whole.

PLOWS.	Depth of furrow, inches.	Width of furrow, inches.	Draught in pounds.	Size of prism in square inches.	Number of pounds required to turn each square inch.
Swivel, No. 4	7.05	13.65	505	96.23	5.87
No. 69	7.94	17.80	663	141.33	4.69
No. 65	5.65	11	463	62.15	7.45
Sod and Subsoil	11.50	12	897	138.00	6.50
Average	8.03	13.61	647	109.43	6.10

(*a*) We learn from this table that, with prisms varying very much in size, the largest being nearly two and one half times greater than the smallest, the power required for cutting and turning a lap furrow is expressed by 6.10 pounds for each sectional square inch of the furrow slice.

(*b*) We learn also that large furrow slices are turned with more economy of power than smaller ones. The average power required to turn the two smaller furrow slices of 79.19 square inches was 6.66 pounds per square inch, while the power required to turn the two larger ones of 139.66 square inches was 5.55 pounds, or the smaller required 1.11 pounds more power than the larger. This result appears less favorably when considered with reference to the average depth of the furrows than it does in relation to the square inches. The two shallowest furrows average 6.35 inches in depth, and require 80.94 pounds for each inch of depth. The two deepest furrows average 9.72 inches in depth, and require 80.24 pounds for each inch of depth.

(*c*) The sod and subsoil plow seems to require more power than it does when it is worked with a coulter. Considered with reference to the sectional area of the slice, the sod and subsoil requires 6.50 pounds of power for each square inch, while it only requires 4.69 pounds per square inch when used with the coulter. Considered with reference to the depth, each inch of the sod and subsoil requires 78.00 pounds of power, while with the coulter it requires 83.50 pounds, showing a greater expense of power in the sod and subsoil plow of 1.81 pounds for each square inch of sectional area, and 5.50 pounds less power for each inch in depth.

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(*d*) No. 69 requires 1.18 pounds less power for each square inch of sectional area than the swivel and 2.14 pounds less for each inch in depth. The swivel consumes 80.14 pounds and No. 69 consumes 78.00 pounds of power for each inch of depth.

(*e*) No. 65 consumes 0.95 pounds more of power for each square inch of sectional area of furrow than the sod and subsoil plow, and 3.94 pounds more for each inch of depth. No. 65 consumes 81.94 pounds, and the sod and subsoil 78.00 pounds for each inch of depth.

In order to afford the means of comparison, we here insert some of the results arrived at by Mr. Pusey and Mr. Morton, which are given in full in the report on the trials of plows at Utica, in September, 1867:

The average draught of Mr. Pusey's first four furrows of 5, 6, 7 and 8 inches deep was 53.84 pounds for each inch in depth. The average draught of his last four furrows, 9, 10, 11 and 12 inches deep, was 57 pounds for each inch in depth. In both cases the furrow was nine inches wide.

In Mr. Morton's experiments the shallower furrows showed an average draught of 85.40 pounds for each inch in depth; the deeper ones averaged 94.62 pounds; the furrow in both cases was nine inches.

The power required in Mr. Pusey's experiments for each square inch of average sectional area of the furrow slice in the four shallowest furrows was 5.98 pounds; the four deepest furrows required 6.38 pounds.

In Mr. Morton's, each square inch of sectional area in the shallowest furrows required 9.49 pounds, and for the deepest 10.51 pounds.

The experiments of Messrs. Pusey and Morton agree in making the power required to turn each square inch of the sectional area greater in deep than in shallow furrows, the excess, according to Mr. Pusey, being six per cent, and according to Mr. Morton it is ten per cent. According to our experiments it is seventeen per cent less. Ours were made with different plows, while each of theirs was made with the same plow, which may partly account for the discrepancy. But the practical point is very clear, from all the experiments, that the power required for deep plowing is not materially greater in proportion to the work done. A furrow twelve inches deep can be plowed with about twice as much power as a furrow six inches deep. The actual power consumed by each successive inch in depth was, according to the average of

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our experiments for all the plows, 64.05 pounds. According to Mr. Pusey's experiments the difference for each inch was 63.33 pounds. According to Mr. Morton's, the difference was 86.66 pounds.

II. What is the increase of power required for each successive inch of width in plowing?

We answer this question by the following table, showing the result of experiments made for the purpose with Holbrook's Plow No. 65. The coulter was set with its point two inches above the sole of the plow. We began with the narrowest furrow, working gradually wider. All the furrows were intended to be seven inches deep, and all were so except the eighty-fourth, which was six inches deep:

No. of experiment.	Width of furrow, inches.	Draught in pounds.	REMARKS.
*84	8	363	
*85	8	415	Average of eighty-fifth and eighty-sixth experiments, 441 pounds.
*86	8	467	
*87	9	438	Average of eighty-seventh and eighty-eighth experiments, 443 pounds.
*88	9	453	
89	16	525	Average of eighty-ninth and ninetieth experiments, 522 pounds.
90	16	519	
91	15	509	Average of ninety-first and ninety-second experiments, 496 pounds.
92	15	504	
†93	14	513	Average of ninety-third and ninety-fourth experiments, 499 pounds.
94	14	485	
95	13	453	Average of ninety-fifth and ninety-sixth experiments, 454 pounds.
96	13	455	
97	12	451	Average of ninety-seventh and ninety-eighth experiments, 454 pounds.
98	12	458	
99	10	454	Average of ninety-ninth and one hundredth experiments, 456 pounds.
100	10	459	
101	8	421	Average of one hundred and first and one hundred and second experiment, 405 pounds.
102	8	389	

* These experiments made it evident that the plow was working unnaturally. Each successive furrow was wider than the next succeeding one; the sole of the plow was therefore wedged by the shoulder thus formed, and required more power than it would if the channel on the right hand had been free. We, therefore, concluded to begin with the widest furrow and work down to the narrowest. The coulter was set flush with the land side.

† Stones in the bottom of the furrow.

‡ At this point we set the point of the coulter one-quarter of an inch in from the land side.

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The average width of the furrows from the eighty-ninth to one hundred and second experiment was 12.57 inches; the average draught was 469 pounds; the average increase of draught for each inch is 19½ pounds.

Recapitulation.

Width of furrow, inches.	Draught in pounds.	Difference, pounds.	Size of prism, square inches.	Draught of each square inch of sectional area, in pounds.
16	522	..	112	4.64
15	496	26	105	4.72
14	499	3 +	98	5.09
13	454	45	91	4.99
12	454	..	84	5.40
10	456	2 +	70	6.51
8	405	51	56	7.30

It will be observed that the draught required for each square inch of sectional area increases as the size of the area diminishes. This accounts for the greater amount of draught of this plow, as shown in the table on pages 268, 269.

III. What is the increase of power required when the furrow slice remains of the same size for each successive increment of velocity?

We endeavored to answer this question by the following experiments made with Holbrook's Plow No. 65, cutting a furrow seven inches deep and fourteen inches wide:

No. of experiment.	Seconds.	Yards.	Pounds.	AVERAGE.		
				Seconds.	Yards.	Pounds.
103....	96	76	450	...	..	....
104....	125	76	519	110	76	484½
105....	57	75	480	57½	74	500
106....	58	73	520	...	..	....
107....	25	68	685	...	..	....
108....	26	68.	676	25½	68	680

In order to facilitate a comparison of our experiments with those of Mr. Pusey, which are given in the report on plows, we give the following table, in which the preceding experiments are repeated in another form:

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Rate of going per hour.	Time required to plow an acre.	Draught of plow.
$1\frac{5}{100}$ miles.	4 hours, 25 minutes.	$484\frac{1}{2}$ pounds.
$2\frac{67}{100}$ "	2 " 39 "	500 "
$5\frac{45}{100}$ "	1 " 18 "	680 "

It appears from the foregoing that, when the speed on the second trial was very nearly doubled, the draught was only increased $15\frac{1}{2}$ pounds, which was probably due to inequalities in the soil; and when, in the third trial, the speed was again more than doubled, the draught was only increased 180 pounds. It may be considered as fully settled that velocity has very little influence on draught. The last experiment does, indeed, show that the draught was somewhat increased, and this was also the case in the experiments of Messrs. Morton and Pusey; but the cause of this increase was very apparent in our trials; and we have no doubt that it was also the case in theirs. When the speed rose to five and one-half miles an hour (nearly), the soil was thrown upwards thirty inches high, and laterally four feet, so that four of the preceding furrows were covered with pulverized earth. It was this upward and lateral throw of the earth which consumed the 180 pounds of power. So long as the speed is not increased to the point where the earth is thrown upward and laterally, we think it is demonstrated beyond all possibility of doubt that the power required in plowing is not increased by an increase of speed.

IV. What proportion of the total amount of power consumed in plowing is absorbed by the different parts of the plow, viz., the sole, the land side, the share, the mould board?

Experiment No. 38.—The surface draught of No. 65 (weight, 130 pounds) was 78 pounds.

Experiment No. 15.—The surface draught of No. 69 (weight, 140 pounds) was 118 pounds.

The greater surface draught of the latter was probably owing to the greater breadth of the sole, measured from the land side to the angle of the feather.

The average draught of No. 65, plowing seven inches deep, as shown in experiments Nos. 49, 50 and 51, was 512 pounds.

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The mould-board was removed from No. 65, and the plow was made to run seven inches deep, with the following results:

No. of experiments.	Draught, pounds.	REMARKS
109.....	478	Average of one hundred and ninth and one hundred tenth experiments, 482 pounds.
110.....	485	

The consumption of power by the mould-board would thus appear to be 482 — 512 = 30 pounds, or 5.8 per cent, of the whole amount; the consumption by the sole, 14.5 per cent of the whole amount.

In Mr. Morton's experiments, 10 per cent of the whole power was consumed in turning the furrow, which is very small, but 4.2 per cent less than our experiments would indicate. In Mr. Pusey's experiments, 50 per cent of the power was consumed in what he calls surface draught; but it must be observed that this was obtained by running the plow through an empty furrow, and embraces the friction of the land side as well as of the sole, whereas ours was obtained by simply allowing the plow to run over the top of the ground, and we therefore obtained the friction of the sole without being complicated by the land side.

The plows which we used were so constructed that the land side could not be detached from the share, and we were, therefore, unable to determine the power required by the land side and the share separately.

The power required to draw the plow through a furrow seven inches deep was, as we have seen, 512 pounds. Power absorbed by the sole, 77 pounds; power absorbed by the mould-board, 30 pounds. Now, if we assume with Mr. Pusey, that the sole and land side together consume 50 per cent of the whole power, then 50 — 1.45 = 35.5 per cent, which is absorbed by the land side; therefore, the power consumed by the land side is 179 pounds, leaving for the power required for share and coulter 226 pounds.

V. What is the influence of the coulter on draught?

Mr. Stephens has stated the result of a very remarkable experiment tried by him to ascertain the influence of the coulter upon the draught. He adjusted a plow with a coulter which projected seven inches below the sole of the plow, and having adjusted the hook of the whiffle-trees in the bridle, so that the sole would

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swim freely on the surface without any tendency to dip into the ground, he proceeded to measure the surface draught and the cutting action of the coulter seven inches beneath the surface of the ground. The draught in this case was 364 pounds. The draught when the coulter was removed and the plow was drawn over the surface of the ground was 112 pounds, which, being deducted from the whole draught, leaves 252 pounds as the draught of the coulter. Mr. Stephens further states, that a well trimmed plow, turning a furrow seven inches deep and ten inches broad, was at work in the same field, the draught of which was only 364 pounds. The same plow, after the coulter was removed, was put to plow a furrow seven inches by ten inches, and its draught was also 364 pounds. It would, therefore, appear from this experiment that the surface draught, and the coulter running seven inches into the ground, required as much power as it does to turn a complete furrow seven inches by ten inches.

Experiment No. 111.—We desired to verify this experiment, and we accordingly affixed a coulter which had been specially prepared for the purpose to No. 65, so that it projected six inches below the sole. The bridle of the plow was not long enough to enable us to bring it into proper trim, so as to prevent it from running into the ground, but finally, by attaching a chain to the guides of the wheel it worked very satisfactorily. The draught (including the surface draught) was 296 pounds; deducting the surface draught, which is 77 pounds, we have 219 pounds for the power consumed by the coulter, which is 33 pounds less than Mr. Stephens found; but as his coulter ran one inch deeper than ours, and would therefore necessarily consume more power, the agreement is quite as close as could be expected.

Experiment No. 112.—We then removed the coulter, and plowed a furrow six inches deep and eleven inches wide. The draft was now 417 pounds, or 121 pounds more than was required for the surface draught of the plow, and to cut six inches into the ground.

In order to complete this experiment on the influence of the coulter, we should have plowed a few furrows of the same size, with the coulter adjusted in the ordinary way; but the importance of the experiment escaped our attention at the moment.

Experiment No. 113.—We thought of it afterwards, and tried the experiment, but we were at that time plowing in a denser soil, and the comparison was, therefore, not exact. The draught in the-

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soil where we tried it was 443 pounds, or 26 pounds more than it was without a coulter. We record the experiment exactly as it was made, leaving each one to draw his own conclusions; but, in our judgment, although the use of a coulter in sod ground makes much better work, it does not have much effect on the draught in any way.

This opinion must, however, be modified with respect to the *swivel* plows, which evidently worked much more easily with a coulter, as appears by comparing the results of experiments Nos. 9, 10 and 11:

	Pounds.
Experiments Nos. 9 and 10	469
Experiment No. 11	582
Difference in favor of coulter	113

It does not appear from our experiments that the depth of the coulter in the soil, so long as it does not run below the sole of the plow, affects the draught. (See experiments Nos. 12, 13 and 14.) But, if the coulter is used, our experiments show very decidedly that much depends upon its being in a proper condition. On comparing the average of the fifty-sixth, fifty-seventh and fifty-eighth experiments (545 pounds) with the average of the sixtieth and sixty-first (512 pounds), it will be seen that 33 pounds were saved by the use of a sharp coulter.

It was not found that the rake of the coulter made any material difference when plowing among fibrous roots, but it became necessary to give it more rake when plowing among *rhizomes*, such as quack roots. This fact was well exemplified in experiments sixty and sixty-one (512 pounds). The rake was then increased very considerably in experiments sixty-two to sixty-five (452 pounds), showing a reduction in power of 59 pounds. On examining the edge of the cutter it was found that there was a rough wire edge on it, and it was then rubbed down smooth with a scythe-stone, and the draught fell, in the sixty-sixth and sixty-seventh experiments, to 422 pounds. It was then found that the coulter had slipped and lost most of the rake that had been given to it during the last two experiments. It was again adjusted properly, and from the sixty-eighth to the seventy-first experiment the draught was 389 pounds. These experiments show a reduction in draught of 156 pounds by putting the coulter in proper order.

VI. Does the skim plow consume more or less power than the coulter?

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Experiment No. 114—No. 69 was furnished with a coulter and a stubble mould-board, the furrow being nine inches deep and twelve inches wide. The draught of the plow, thus adjusted, was 729 pounds.

Experiment No. 115.—The coulter was then withdrawn from the plow, and a skim plow was placed on the beam and set to work with a furrow of the same size; draught, 659 pounds, showing a difference of 70 pounds in favor of the skim plow. These experiments are believed to give a sufficient answer to the question.

VII. What is the elasticity of different soils?

We did not try this experiment as fully as it deserves, as we found it would require more time and expense to do so than we could well afford; but we performed it carefully in different parts of the same field, which differed considerably in consistency.

Experiment No. 116.—Referring to the report of the judges of the Utica trial for the method of making it, we have to state that, with a furrow eleven inches deep and sixteen inches broad, the upper part of the slice in the most tenacious part of the field would stretch seven and a half inches beyond the lower portion before breaking; in the least tenacious part it would stretch four and three-quarter inches; and soils of intermediate tenacity would stretch in proportion.

Experiment No. 117.—The stretch diminished according to the shallowness of the furrow slice. At four inches deep it would not stretch much more than an inch in the toughest part of the field, and in the loosest part it would not much exceed half an inch. At six inches deep it stretched two and a half inches, and at eight inches deep, a little over three inches.

This great difference in the elasticity of soils shows how impossible it is to make any one plow which shall work equally well in all soils. If it has a sufficient twist to break the *least* tenacious soils, it will utterly fail to disintegrate those which are *more* tenacious. If, on the other hand, it has enough sharpness of twist to disintegrate the most tenacious soils, it will cause a great waste of power when used in less tenacious soils. All that can be reasonably asked of a plowmaker is that, a soil and depth of furrow being given, he shall make a plow which will disintegrate it most thoroughly with the least expenditure of power. It by no means follows that it will be the best plow in any other soil?

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VIII. What is the influence of the wheel on draught?

We are ashamed to be obliged to state that we quite overlooked this part of our programme, and are therefore unable to give an experimental answer to this question.

IX. What is the influence of the plowman on draught?

We have already answered this question incidentally in the earlier portions of this report. In some cases, where he was obliged to exert his force through a lever to counteract a tendency to irregularity, in consequence of a maladjustment of the parts, the extra power required rose up to 115 pounds. In all cases the lightest draught was shown where the plow ran with the least interference on the part of the plowman.

We cannot close our report of these trials without the expression of our sincere thanks to Gov. Holbrook and Mr. Joel Nourse for the very valuable assistance which they rendered to us, without which our labors would have been much less fruitful.

JOHN STANTON GOULD,
HENRY WATERMAN,
Committee.

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